Examining the Impacts of Bank Competition and Stock Market Liquidity on Bank Liquidity Creation: Evidence from Malaysia

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Standard bank liquidity creation theory asserts that banks create liquidity by issuing credit for liquidity-constrained agents who have production opportunities with returns increasing on the investment horizon, and in the meantime, allowing prompt deposit withdrawals by agents who wish to invest their excess liquidity, but face random future consumption shocks. By holding illiquid non-monetary assets on behalf of the public, banks bestow upon the economy new liquidity created for economic development activities. A well-functioning liquidity creation role of banks is thus of vital importance in promoting the long-run economic growth of a country, particularly a country that adopts a bank-oriented financial system.

Commercial banks in Malaysia have faced a formidable increase in competitive pressure exerted from both within the banking industry and the domestic stock market since the 1990s, a process triggered by financial liberalisation, innovation and disintermediation. These developments have drawn attention to the influences of bank competition and stock market liquidity on the liquidity creation role of commercial banks in the country. The extant theoretical literature has enhanced our understanding of the relationships between bank competition and bank liquidity creation and between stock market liquidity and bank liquidity creation, and very often, the relationships come from two contradictory directions and are empirically inconclusive for countries that remain unexamined. Hence, this study aims to examine the relationship of bank competition and stock market liquidity on liquidity creation by Malaysian commercial banks. The study also investigates how the bank competition-liquidity creation relationship differs by bank size, given consideration of the discernible differences in the type of lending technology specialisation and capacity between large and small banks. To address the research objectives, a fixed effects estimator is employed on a panel dataset of Malaysian commercial banks for the period 2001 to 2013.

This study documents several key findings. First, when facing a rise in bank competition small banks cut down their liquidity creation through both on-balance sheet and off-balance sheet activities. Credit rationing is more severe for small banks that have lower market power, in particular, by reducing their specialised soft lending arrangements to informationally-opaque or risky customers to avoid bearing costly information production and customer monitoring. Second, large banks that encounter greater competition tend to increase liquidity creation mainly through on-balance sheet activities. The specialisation in hard lending technologies and the strong capacity of large banks, for example, in terms of extensive branch networks, technology diffusion and capital, provide possible explanations for the ability of the large banks to tolerate a lower interest spread to leverage their liquidity creation business in existing and new market segments. Third, this study finds that a negative bank competition-liquidity creation relationship dominates the Malaysian commercial banking industry, which implies that banks take informational asymmetry-related costs into greater consideration in their lending decisions when competition increases. Another possible explanation for the moderation of bank liquidity creation is greater income diversification from interest-based towards fee-based activities in the midst of rising bank competition. Finally, the result shows that increased stock market liquidity does stimulate bank liquidity creation, and such an impact is carried through to both on- and off-balance sheet liquidity creation.

Keywords: Liquidity creation, Bank competition, Stock market liquidity, Market power; Bank size

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Table of Contents

List of Tables

List of Figures

Abbreviations

ACE	Access, Certainty and Efficiency
ASEAN	Association of Southeast Asian Nations
ATM	Automated Teller Machine
BNM	Bank Negara Malaysia or the Central Bank of Malaysia
BTS	Bursa Trade Securities
CDS	Central Depository System
CGC	Credit Guarantee Corporation
CMP	Capital Market Masterplan
DFI	Development Financial Institution
DIS	Deposit Insurance System
EPF	Employees Provident Fund
ES	Efficient-structure
ETF	Exchange Traded Fund
FSA	Financial Services Act 2013
FSMP	Financial Sector Masterplan
FTSE	Financial Times Stock Exchange
GDP	Gross domestic product
GLIC	Government-linked investment companies
GMM	Generalised Method of Moments
IBS	Islamic Banking Scheme
IBFC	Labuan International Business and Financial Centre
IMF	International Monetary Fund
IO	Industrial organisation
ISS	Institutional Settlement Service
IV	Instrumental variables
KLCI	Kuala Lumpur Composite Index
KLSE	Kuala Lumpur Stock Exchange
KWAP	Kumpulan Wang Persaraan or Retirement Fund Incorporated
LTAT	Lembaga Tabung Angkatan Tentera or Malaysian Armed Forces Fund Board
MCD	Malaysian Central Depository
MDIC	Malaysia Deposit Insurance Corporation
MESDAQ	Malaysian Exchange of Securities Dealing and Automated Quotation

MYR	Malaysian Ringgit
NSSBF	National Survey of Small Business Finance
NTCP	Non-trading clearing participants
OECD	Organisation for Economic Cooperation and Development
OPR	Overnight Policy Rate
PG	Portfolio Guarantee scheme
PNB	Permodalan Nasional Berhad
PR	Panzar-Rosse
REIT	Real Estate Investment Trust
SCANS	Securities Clearing Automated Network Services
SCORE	System on Computerised Order Routing and Execution
SCM	Securities Commission Malaysia
SCP	Structure-conduct-performance
SME	Small and medium enterprise
SRA	Statutory Reserve Account
SRR	Statutory Reserve Requirement
WTO	World Trade Organisation
2SLS	Two-stage least-squares

Chapter 1

Introduction

1.1 Research background

The importance of banks' liquidity creation role in economic development has long been recognised by economists and can be dated back at least to Smith (1776). According to the standard bank liquidity creation theory, banks create liquidity by issuing credit for liquidity-constrained agents who have production opportunities with returns increasing on the investment horizon, and in the meantime, allowing prompt deposit withdrawals by agents who wish to invest their excess liquidity, but face random future consumption shocks (Diamond & Dybvig, 1983; Diamond & Rajan, 2001; Dutta & Kapur, 1993; Fulghieri & Rovelli, 1998). Contemporary bank liquidity creation theories developed by Holmstrom and Tirole (1998) and Kashyap et al. (2002) suggest that banks also create liquidity off the balance sheet through commitment-based lending activities that allow liquidity-constrained agents to withdraw liquidity from banks upon demand. By holding illiquid non-monetary assets on behalf of the public, banks bestow upon the economy new liquidity created for economic development activities, such as household consumption and business investment.

It is well known that regulators favour and implement pro-competition initiatives in the banking industry to enhance access to bank products and services by the public and thus the public welfare. Such thought can be translated to the "price channel" view which contends that there is a positive relationship between bank competition and bank liquidity creation (Horvath et al., 2013, 2016). The "price channel" view, which is in fact underpinned by the standard industrial organisation theory, argues that banks that face increased competition are likely to adjust the pricing and other contract terms of their products and services in order to attract more demand for their liquidity creation undertakings such as loan and deposit contracts (Beck et al., 2004; Carbo-Valverde et al., 2009; Hainz et al., 2013; Love & Martinez Peria, 2012).

However, existing bank competition-liquidity creation studies have reported the opposing view, that is, the "fragility channel" hypothesis that purports a negative relationship between bank competition and bank liquidity creation, for banks in OECD, the U.S. and European countries (Horvath et al., 2013, 2016; Jiang et al. (2016), Joh & Kim, 2012; Xu, 2010). The hypothesis incorporates asymmetric information justifications of financial intermediation and argues that increased bank competition breaks lending relationships down more easily, making it more difficult for banks to internalise the

benefits of lending relationships and weakening the banks' incentive to invest in soft information acquisition, particularly through relationship lending with informationally-opaque customers (Petersen & Rajan, 1995; Dell'Ariccia & Marquez, 2004; Hauswald & Marquez, 2006). As a result, less credit is made available to the public and the amount of liquidity creation falls. Further, the finding of Carletti and Leonello (2011) also provides a possible explanation for the "fragility channel" hypothesis. Carletti and Leonello found that an increase in competition makes bank lending less profitable and banks create less liquidity by maintaining more reserves within the system and issuing fewer loan contracts in order to increase the buffer against the credit and liquidity risks.

Given that there are two opposing hypotheses related to the relationship between bank competition and bank liquidity creation, the existing empirical evidence remains debatable for other countries that have not been examined, for example, Malaysia. Other unexamined questions arise: Does the relationship between bank competition and liquidity creation follow bank size? If it does, then how does the relationship differ? While a number of empirical studies have shown that the determinants of bank liquidity creation vary by bank size, for instance, studies by Berger and Bouwman (2009), Berger et al. (2010) and Joh and Kim (2012), no study has presented explicit evidence related to the effect of competition on bank liquidity creation by bank size. It is possible that the "fragility channel" hypothesis and the "price channel" hypothesis coexist in a country because bank competition does not affect large banks and small banks uniformly.

A large body of literature has documented that small banks have a comparative advantage over large banks in the use of soft information in lending technologies, such as relationship lending and judgement lending, because the flat organisational structure of small banks allows processing and communication of information across hierarchy levels and delegation of decision making authority, which cannot be replicated by large banks without distortion (Berger & Black, 2011; Berger & Udell, 2006; Berger et al., 2005b; Cole et al, 2004; Stein, 2002). In contrast, large banks specialise in hard lending technologies, such as asset-based lending and credit-scoring, that help in mitigating the agency problem within the banks. Further, Berger and Bouwman (2016) show that the balance sheet undertakings of large banks in the U.S. are distinguishably different from those of small banks. For example, large banks tend to maintain a greater portion of commercial and industrial loans in their loan portfolios than small banks due to their larger capability such as funding resources and economies of scale in hard lending technology adoption. Further, large banks typically maintain lower capital ratio than small banks, reflecting their risk taking behaviour endorsed by the "too big to fail" doctrine. Hence, the influence of bank size on bank activities raises the important issue of

whether large banks behave differently from small banks in liquidity creation when facing increased competition.

The current global trend toward a market-based financial system also raises concerns about the influence of stock market liquidity on bank liquidity creation, which is another subject of interest that has received marginal attention from empirical researchers. A liquid stock market indicates that investors are able to trade their shares quickly at low cost without affecting the share prices substantially (Chordia et al., 2005; Levine et al., 2005; Sarr & Lybek, 2002). Early theoretical studies have predicted that a liquid stock market will reduce the significance of the liquidity creator role of banks in the economy, which this present study refers to as the "market-bank liquidity crowding out" hypothesis. For example, Bencivenga et al. (1995), Diamond (1997), Levine (1991) and Wallace (1988) collectively found that a liquid stock market allows investors (or savers) to reallocate their claims efficiently in the market when their desired holdings change unexpectedly (possibly due to consumption shocks). Thus, investors' concerns about long-term capital commitment in the securities are alleviated, motivating investors to reallocate their savings from banks to the market. Moreover, Bencivenga et al. (1995), Diamond (1997) and Levine (1991) reported that increased stock market liquidity attracts firms to raise capital for longer-term and higher-return investments through the market as firms are able to issue securities at attractive prices and low costs. As an increase in stock market liquidity leads to less savings being placed with banks and less loan demand from banks, the liquidity creation of banks is hampered.

However, there exists another set of theories in recent years, to which this present study refers collectively as the "market-bank liquidity enhancement" hypothesis, predicting that stock market liquidity improves bank liquidity creation (Mattana & Panetti, 2014; Rajan, 1998; Song & Thakor, 2010). Mattana and Panetti (2014) theoretically found that a liquid stock market provides ready exit-options for investors that face consumption shocks and diverts some demand for liquidity away from the banks, which in turn encourages the banks to shift their asset portfolio from liquid reserves towards illiquid assets. Song and Thakor (2010) argue that increased stock market liquidity enhances the magnitude of liquidity creation by publicly-listed banks by making equity raising from the market cheaper to meet the higher capital requirements associated with greater lending scope to potentially creditworthy yet previously unserved borrowers. Besides, a liquid stock market may also stimulate greater use of off-balance sheet credit commitments that provide a primary backup source of corporate financing in the case that the firms fail to raise equity up to their expectation (Dinc, 2000; Rajan, 1998). Despite the rich theoretical predictions in this field, empirical evidence in favour of either the "market-bank liquidity crowding out" hypothesis or the "market-bank liquidity

enhancement" hypothesis is very limited. The only empirical study was conducted by Chatterjee (2015) who examined the influence of stock market liquidity on liquidity creation by the U.S. commercial banks from 1984 to 2010 and advocated the "market-bank liquidity enhancement" hypothesis. More empirical studies are needed.

1.2 Research problem and objectives

Inspired by the research gaps highlighted in the previous section, this study aims to provide empirical evidence on how bank competition and stock market liquidity are linked to the liquidity creation of commercial banks in Malaysia. Specifically, this study aims to achieve four research objectives:

i. To examine and compare the relationship between bank competition and the liquidity creation of Malaysian commercial banks by bank size;
ii. To identify the dominant relationship between bank competition and liquidity creation in the Malaysian commercial banking industry;
iii. To examine the relationship between stock market liquidity and the liquidity creation of Malaysian commercial banks; and
iv. To provide policy implications related to bank competition and stock market liquidity in the context of liquidity creation by Malaysian commercial banks.

This study addresses the objectives in the context of the Malaysian commercial banking industry for several reasons. First, the operational disparities between the large and small commercial banks in Malaysia are apparent. The commercial banking market is highly concentrated, with the largest three banks dominating almost half of the total bank assets (47%) over the years 2001 to 2013 (based on our calculation). Large commercial banks have generally established extensive branch networks throughout the country's thirteen states and three federal territories, as compared to small commercial banks operating only three branch offices on average, usually based in developed cities such as Kuala Lumpur (The Association of Banks in Malaysia, 2016). These small banks generally target a market based on high value corporate clients by providing personalized products and services, as opposed to the the mass consumer and corporate customers served by the large, geographically diversified banks at arm's length (BNM, 2001). The existence of the credit bureau in Malaysia may imply that the banking market is more challenging for small banks that also rely on soft information when making lending decisions for information-opaque customers. This is because the credit bureau has been found to restrain banks' *ex post* monopoly of information and ability to retain customers, which diminishes their incentive to extend loans to informationally-opaque customers (Pagano & Jappelli, 1993; Padilla & Pagan, 1997).

The second reason is that the Malaysian government (instead of private sectors) remains the major player in the country's financial system and economic development, both directly and indirectly (World Bank, 2013). Several large commercial banks are indirectly linked to the government through government investment arms. Although the government allegedly does not interfere with the management of government-linked banks and all the banks are subject to the same regulation standards, products offered by these banks may carry a perceived implicit guarantee that may lead to an imbalanced development of the banking system (World Bank, 2013). In addition, to enhance small and medium enterprises' (SMEs) access to external financing and to boost the growth of SMEs, the national Credit Guarantee Corporation (CGC) has continually forged strategic alliances with leading banks to provide guarantees for bank loans obtained by the SMEs, under various guarantee schemes such as the Portfolio Guarantee (PG) scheme (CGC Malaysia, 2014)[1]. Owing to the nationwide spread of branch operations, large banks have benefited mostly from these CGC initiatives, which does not only enhance the banks' capacity for liquidity creation, but also presents an unequal playing field for smaller bank players.

Third, unlike most bank-based financial systems, Malaysia adopts a dual-banking system in which commercial banks and Islamic banks operate side-by-side but under two different regulatory frameworks (BNM, 2015). Islamic banks, which comply with Sharia law, are locally oriented and compete directly with commercial banks in consumer lending and deposit activities. Owing to the government's supportive initiatives for Islamic banks, for instance, a favourable tax regime, the number of Islamic banks in Malaysia surged from two banks to 16 banks over the period 2001-2013. The Islamic banking market share increased to account for 23 percent (2007: 8 percent) of total assets, 21 percent (2007: 7 percent) of total loans and 23 percent (2007: 9 percent) of total deposits of the banking system at the end of 2013 (http://www.bnm.gov.my/). The backdrop of a dual banking system in Malaysia offers an interesting context to study the effect of bank competition on the liquidity creation role of commercial banks.

Lastly, it is interesting to examine how stock market liquidity is related to the liquidity creation of commercial banks in Malaysia, because the Malaysian stock market has been highly illiquid for a long time (based on stock market turnover ratio) as compared to the ASEAN (Association of Southeast Asian Nations) peer average, the world average and that of the U.S., despite its large capitalisation

[1] The Credit Guarantee Corporation was established on July 5, 1972 to assist SMEs in obtaining funds from financial institutions by offering loan guarantees, financing facilities and advisory services to SMEs (CGC Malaysia, 2014).

(Author's calculation; Demirgüç-Kunt & Levine, 1996a). The phenomenon in the Malaysian stock market is rare as compared to the typical stock market development in the U.S. and the U.K., that is, a large stock market is accompanied by high market liquidity, because, theoretically, a large stock market is more attractive to investors as the market enhances the ability of investors to mobilise capital and diversify risk (Demirgüç-Kunt & Levine, 1996a).

1.3 Research contribution

The contributions of this study are from two perspectives – a research perspective and a policy perspective. From a research perspective, the research objectives one to three of this study fill the gaps in the literature. Pertaining to our first objective, this study may represent the first empirical study that directly examines the relationship between bank competition and liquidity creation by bank size. Abundant literature has focused on the bank competition-liquidity creation relationship and the bank size-lending relationship in separate strands. Thus, by shedding new light on how banks of different sizes may behave differently in liquidity creation undertakings when facing increased competition, our findings will contribute to these literature strands. For the second objective, we have identified only four empirical studies that explicitly investigated the relationship between bank competition and liquidity creation. These studies were conducted by Horvath et al. (2013, 2016), Jiang et al. (2016), Joh and Kim (2012) and Xu (2010) for banks in the Czech Republic, the U.S., 25 OECD countries and 26 European countries, respectively. Our study is the first empirical study for Malaysia in this field. Besides, theories that link stock market liquidity to bank liquidity creation can generally be referred to as the "market-bank liquidity crowding out" hypothesis and the "market-bank liquidity enhancement" hypothesis, with both predicting opposite directions (Bencivenga et al., 1995; Diamond, 1997; Levine, 1991; Wallace, 1988; Mattana & Panetti, 2014; Rajan, 1998; Song & Thakor, 2010). Despite the rich theoretical predictions, the empirical evidence in this field is very limited. Chatterjee's (2015) study for the U.S. is the only work to our knowledge. Thus, this study regards the third research objective as imperative to test the theoretical predictions in the Malaysian financial environment and to fill the gap in the literature.

Besides, this study contributes to the literature by providing more detailed analyses than previous relevant studies in several ways. First, our liquidity creation measures are calculated using both the category and maturity classification approaches, unlike previous studies that usually employ a selected classification approach only. For example, Horvath et al. (2013, 2016) employed only total liquidity creation and on-balance sheet liquidity creation measures based on maturity classification, and both Joh and Kim (2012) and Xu (2010) employed only total liquidity creation based on category

classification. This present study provides more detailed analyses than these prior studies because we employ four liquidity creation measures, which are total liquidity creation and on-balance sheet liquidity creation measures based on both the category and maturity classification approaches. We also use an additional measure of bank liquidity provision through off-balance sheet components only to offer a different perspective on the empirical relationships of interest.

Second, this study employs a non-structural competition measure, the Lerner Index, to measure competition at bank-level. This measurement approach is consistent with Horvath et al's (2013, 2016) and Joh and Kim's (2012) studies, but different that of from Xu (2010) who employed the market share of individual banks to indicate bank competition, which can be problematic because the structural measure has been criticised for not reflecting competition faced by banks and it is difficult to compare results across bank markets and time periods (Carbó-Valverde et al., 2009; Claessens & Laeven, 2004; Degryse & Ongena, 2008). Similarly, a large body of early bank competition-bank lending empirical studies that resorted to market structural measures to indicate bank competition, for example, Beck et al. (2004), Berger and Hannan (1989), Corvoisier and Gropp (2002), Hannan (1991) and Heitfield and Prager (2004), cannot offer unambiguous implications for the bank competition-liquidity creation literature strand.

Third, this study applies various alternative stock market liquidity measures to offer a deeper insight into whether the choice of stock market liquidity measure may alter the findings for the stock market liquidity-bank liquidity creation relationship. This approach is slightly different from Chatterjee's (2015) study for the U.S. that measures stock market liquidity by proportional quoted bid-ask spread, Amihud's illiquidity ratio and Roll's implied spread. Our study also uses quoted bid-ask spread and Amihud's illiquidity ratio, and is different from the previous study by including turnover ratio, frequency of trading days with zero returns and our own computation of aggregate stock market illiquidity index score[2].

From a policy perspective, this study informs policy makers and practitioners about the developments of bank competition and stock market liquidity in Malaysia and the influences of these developments on the liquidity creation of commercial banks. The findings of this study have direct policy relevance for the future viability of small banks and all banks in general because undue financial liberalisation and other competition efforts can hurt the competitive edge and profitability

[2] We do not use Roll's implied spread because the underlying assumptions of the measure, such as an informationally efficient stock market and stationary price change of stocks, are not satisfied in Malaysia's illiquid stock market.

of these banks. Besides, the use of various stock market liquidity measures in this study allows an assessment of the usefulness of turnover ratio in measuring stock market liquidity in Malaysia. Academics have criticised the turnover ratio for not reflecting changes in the transaction costs on the financial market, but the measure remains widely used by regulators and some international research units, such as the research departments at the World Bank and International Monetary Fund (IMF), for simplicity reasons (Fleming, 2003; Karpoff, 1987; Lesmond, 2005; Rouetbi & Mamoghli, 2014). Supporting the finding of the academics implies that it is important for policy makers to employ a broad set of indicators when gauging stock market liquidity conditions and designing policies. Since the Malaysian economy relies on its banking system to provide and, thus, to create liquidity to stimulate economic growth, if the liquidity creator role of the banks is weakened due to the implementation of improper policies, there will be catastrophic real effects on the economy, such as investment and production output contraction, which may consequently impede achievement of the state of a developed economy by the year 2020, as envisaged by "Vision 2020"[3]. Hence, the findings of this study bear significant policy implications for the bank-based financial system in Malaysia to support a robust monetary system and liquidity condition and economic development.

1.4 Thesis outline

The remainder of this thesis is structured in the following way. Chapter 2 provides a brief overview of the financial system in Malaysia, including the structure and development of the banking sector and stock market. Chapter 3 reviews literature on bank liquidity creation theories, the relationship between bank competition and bank liquidity creation and the relationship between stock market liquidity and bank liquidity creation. The chapter also reviews how banks of different sizes can possibly have different relationships between bank competition and bank liquidity creation. Chapter 4 explains the data and research method used in the study, and Chapter 5 presents and discusses the empirical findings of the study. Chapter 6 concludes the study with the main research findings and policy implications as well as the limitations of the study and potential future study areas.

[3]"Vision 2020" refers to Malaysia's vision to reach the state of a developed economy by the year 2020. The vision was launched by the former Malaysian Prime Minister Tun Dr. Mahathir bin Mohamad in 1991 (Economic Planning Unit, 2013).

Chapter 2

Overview of the Financial System in Malaysia

2.1 Introduction

Since Malaysia's independence in 1957, the domestic financial system has been playing an important role in the economic transformation from a predominantly agrarian economy to an upper middle-income economy today (BNM, 2011a; Randhawa, 2011). The Malaysian financial system mainly encompasses the financial sector and capital market. The financial sector is large and well diversified with commercial and Islamic banking institutions, investment banks, development financial institutions (DFIs) and insurance and Takaful (insurance based on Sharia or Islamic religious law) companies (IMF, 2014; World Bank, 2013). These financial institutions are supervised by the Central Bank of Malaysia (BNM thereafter) which sits at the apex of the financial system to ensure financial and monetary stability is conducive to the sustainable growth of the Malaysian economy (World Bank, 2013). The financial sector also includes pension and provident funds, fund management companies and the Labuan International Business and Financial Centre (IBFC)[4]. Owing to the operations of investment banks that involve trading and brokerage services on capital market products, investment banks are co-regulated by the Securities Commission Malaysia (SCM) that also supervises fund management companies, broker-dealers and the domestic stock, bond, derivatives and other securities market (IMF, 2014; World Bank, 2013).

In the 1990s, Malaysia experienced a rapid economic expansion where the country's real gross domestic product (GDP) growth rate peaked at 10 percent in the year 1996. However, the Malaysian financial system was not robust and resilient to the stress built up during the period of rapid growth as a result of easy liquidity access and increasing asset prices (Randhawa, 2011). The capital market was relatively narrow, illiquid and unsophisticated, thus, the financing of the domestic industrial projects was largely reliant on the banking sector. However, the banking sector was fragmented and fragile, with excess banking institutions in operation (Randhawa, 2011). There were no economies of scale in the banking sector as resources were wasted due to bank surplus and duplication of branches in the same locality. As a result of the uncontrolled credit expansion, most notably in a speculative and highly leveraged property sector, coupled with neglect of prudential lending norms and regulatory oversight, the financial system was badly hit in the wake of the collapse of the Thai

[4] Labuan IBFC, which is supervised independently by the Labuan Services Authority, specialises in offshore banking, insurance, trust, fund management and other activities carried out in foreign currencies

baht on 2 July 1997. Between the years 1997 and 1999, about 18 domestic banks were recapitalised and/or injected with liquidity by BNM or absorbed by another bank (Malaysian Loan, 2011). The Malaysian stock market also experienced a depression, as was evident by a 53 percent drop in market capitalisation from MYR 807 billion at the end-year 1996 to MYR 376 billion at the end-year 1997 and a 52 percent fall in the Kuala Lumpur Composite Index from 1,238 points to 594 points over the same period (http://www.bnm.gov.my/).

Soon after the country made a swift recovery from the crisis, BNM and SCM jointly initiated progressive, phased financial sector and capital market reforms with the ultimate objective of developing a resilient, competitive and dynamic financial system with internationally compliant best practices (BNM, 2001). The impetus towards the financial reforms mainly came both internally and externally from the pressing need to address structural and regulatory weaknesses in the domestic financial system, the growing and diversifying financial needs of the local economy, the global trend towards financial globalisation and deregulation, the rapid technological advances and the implementation of the World Trade Organisation (WTO) accord on financial services in the end-1990s (BNM, 2001; Randhawa, 2011). The financial reforms in Malaysia were guided by the Financial Sector Masterplan (FSMP) and the parallel Capital Market Masterplan (CMP) 1 that covered the period from 2001 to 2010, which have now been succeeded by the Financial Sector Blueprint and CMP2 that cover the period 2011 to 2020. The reforms have, thus far, placed the domestic financial system on a stronger foundation with greater competitiveness and resilience, efficient financial infrastructure and robust regulatory and governance regimes.

For the past six decades, the concentrated banking sector in Malaysia has played the dominant role in allocating resources for the economy. In other words, Malaysia has had a bank-based financial system. Over the years 2007 to 2015, the domestic banking sector extended over 46 percent of new external financing raised by the private sector each year, followed by 24 percent of capital raising in the market (http://www.bnm.gov.my/). Other forms of financing for the Malaysian economy are foreign direct investment, external loans and credit issued by domestic financial intermediaries. It is worth noting that, at the end-year 2015, the size of the Malaysian banking sector, as indicated by banks' total assets, reached MYR 2,354 billion, which was about two times larger than the country's GDP. The Malaysian equity market is also substantially large, given by its capitalization valued at MYR 1,695 billion in 2015. The domestic corporate bond market is small and is at least three times smaller than the stock market, however. The outstanding amount of domestic corporate bonds was about MYR 513 billion at the end-year 2015 (http://www.bnm.gov.my/).

Chapter 2 is divided into three sections. Section 2.2 provides an overview of the Malaysian banking system, while Section 2.3 reviews the stock market which is of interest to this study. Lastly, Section 2.4 shows the key financial and monetary development in Malaysia over the past fifteen years, with the aid of graphical presentation of data.

2.2 Overview of the Malaysian banking system

BNM is a statutory body which began operations on 26 January 1959 under the Central Bank of Malaysia Act 1958 (now known as the Central Bank of Malaysia Act 2009) (BNM, 2014a). Currently, the main objectives of BNM focus on two pillars: monetary stability and financial stability, both aiming at establishing a conducive environment for the sustainable growth of the Malaysian economy. To establish the core foundations of these objectives, BNM supervises nearly all the financial institutions that have played a crucial role in the development of the domestic financial sector.

Since the enactment of the Islamic Banking Act 1983 that has been repealed by the Islamic Financial Services Act 2013, Malaysia has practised a dual-banking system in which conventional banks and Islamic banks operate side-by-side, but under two different regulatory frameworks (BNM, 2015). Commercial and investment banks are regulated under the Financial Services Act 2013 (FSA, previously the Banking and Financial Institutions Act 1989)[5]. Whereas, licensed banking institutions that are interested in offering Islamic banking services have a choice of operating as standalone Islamic banks under the Islamic Financial Services Act 2013 or participating in the Islamic Banking Scheme (IBS) under their existing infrastructures, branches and brand name (BNM, 2007). Islamic offerings must comply with Sharia principles of which a key feature is that interest charging that is commonly practised in commercial banking is strictly banned.

The Malaysian banking system consists of 27 commercial banks, 16 Islamic banks and 11 investment banks as at the end-year 2015 (http://www.bnm.gov.my/). In the late 1990s and the early 2000s, the banking system experienced considerable changes in its players, following reform initiatives implemented under the FSMP. One of the initiatives was a consolidation program that mandated all domestic commercial banks, merchant banks and finance companies to revolve around ten anchor banks in order to form ten financial conglomerates by the early 2000s (BNM, 2001). As shown in

[5] Both FSA and the Islamic Financial Services Act 2013 give BNM oversight powers over financial intermediaries, which allows BNM to react to new risks emerging for the financial system in time to preserve public confidence in the financial system and thus the financial system's stability (BNM, 2015).

Table 2.1, the number of domestic commercial banks decreased significantly from 22 banks in 1998 to 10 anchor banks in 2003, while the absorption exercise of finance companies into anchor banks was completed in 2005. Besides, liberalisation of the country's banking rules for foreign banks, such as more issuance of licences and relaxation of branching restrictions, has successfully attracted greater foreign investment in the domestic market, as evidenced by an increase in the number of locally-incorporated foreign commercial banks from 13 in 1998 to 19 banks at present. Local incorporation is a regulatory requirement for the Malaysian operations of foreign financial institutions, which creates a legal separation between the domestic entity and its foreign parent company (BNM, 2009). Table 2.1 shows the rapid surge of fully-fledged Islamic banks from one bank in 1998 to 16 banks in 2015, which partly reflects the achievement of the FSMP initiatives in promoting the Islamic financial system as well as the competiveness of the domestic banking sector.

The Malaysian banking system has been dominated by commercial banks which enjoy the largest market share in terms of bank assets, loans and deposits. As shown in Figure 2.1, commercial banks controlled about 75.5 percent of total assets in the banking system at the end of 2015, a substantially higher market share compared to the 22.4 percent of Islamic banks and the 2.2 percent of investment banks (http://www.bnm.gov.my/). By controlling about 72.6 percent of the total bank lending and 74.8 percent of the total deposits in the market, commercial banks are the primary liquidity creators in the country. Commercial banks face direct competition with Islamic banks which have about one quarter of market share in bank loans and deposits. Investment banks, on the other hand, have a minimal share in the bank loan and deposit markets owing to the different nature of their business activities (http://www.bnm.gov.my/).

Table 2.1 List of banking institutions in Malaysia from 1998 to 2015

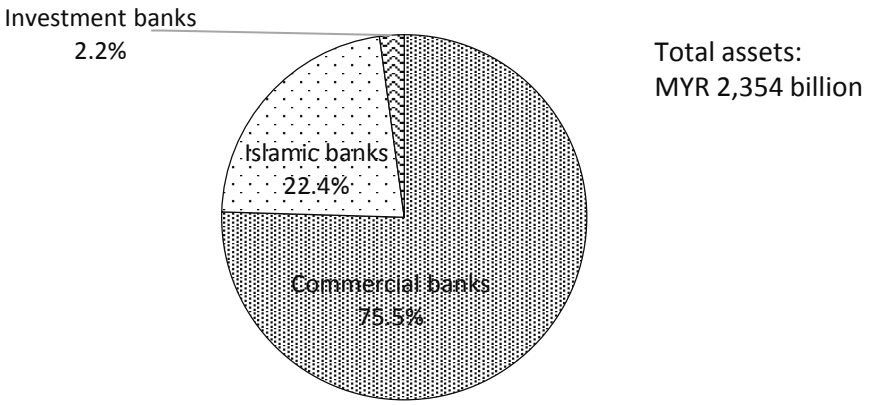
Number of institutions	As at the end of																	
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Commercial banks	35	33	32	25	24	23	23	23	22	22	22	22	23	25	27	27	27	27
Domestic	22	20	18	11	11	10	10	10	9	9	9	9	9	8	8	8	8	8
Foreign	13	13	14	14	13	13	13	13	13	13	13	13	14	17	19	19	19	19
Merchant/ Investment banks*	12	12	12	10	10	10	10	10	10	14	15	15	15	15	13	12	11	11
Islamic banks	1	2	2	2	2	2	2	6	10	11	17	17	17	16	16	16	16	16
Finance companies	31	23	20	12	11	11	6	4	-	-	-	-	-	-	-	-	-	-
Total number	79	70	66	49	47	46	41	43	42	47	54	54	55	56	56	55	54	54

* The term “investment bank” has been used since 2006.

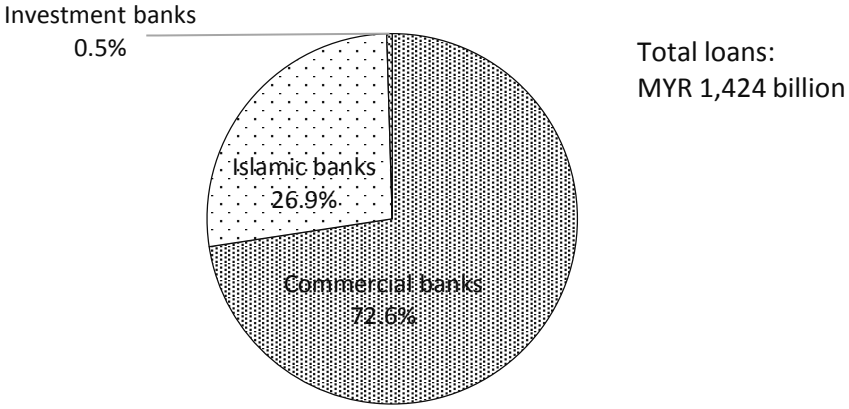
Source: BNM website (http://www.bnm.gov.my/)

Figure 2.1 Breakdown of bank market shares by bank types as at the end of 2015

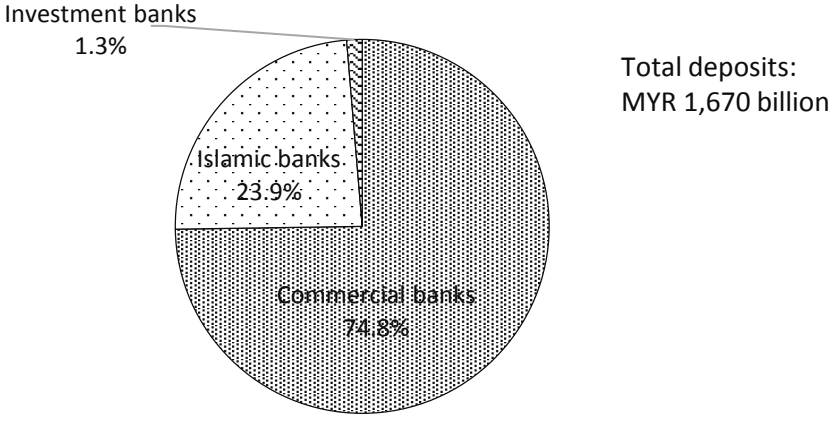
(a) Breakdown of total bank assets by types of banks



(b) Breakdown of total bank loans by types of banks



(c) Breakdown of total bank deposits by types of banks



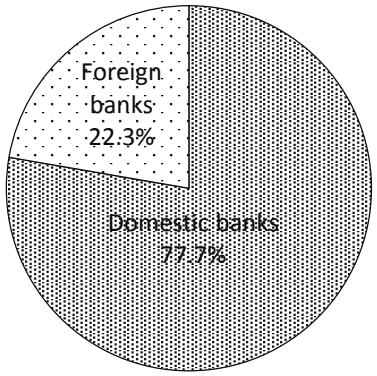
Source: BNM website (http://www.bnm.gov.my/) and author's calculations

Figure 2.2 shows the breakdown of the total market share of commercial and Islamic banks by bank ownership at the end of year 2015. With reference to the three pie charts, domestic commercial and Islamic banks had almost an 80 percent share in the bank asset, loan and deposit markets, while locally-incorporated foreign banks controlled about a 20 percent share in these markets (http://www.bnm.gov.my/). These findings indicate that, despite domestic commercial and Islamic banks in Malaysia being outnumbered by locally incorporated foreign banks (18 domestic banks versus 25 foreign banks), the banking market is concentrated in a few large domestic banks. Most locally incorporated foreign banks are small relative to the few largest domestic banks, but there are some large ones, for example, United Overseas Bank (Malaysia) Berhad, OCBC Bank (Malaysia) Berhad, HSBC Bank Malaysia Berhad and Standard Chartered Bank Malaysia Berhad, each with well over MYR 50 billion in assets as of 2013 (Bankscope database).

In Malaysia, large commercial banks generally establish extensive branch networks throughout the country's thirteen states and three federal territories. To illustrate, Malayan Banking Berhad (Maybank), the largest commercial bank with over MYR 492 billion assets at the end of 2015, had 393 branches or about 20 percent of the total 1,987 bank branches distributed nationwide, as compared to several small commercial banks operating only one branch office, usually based in the capital of Malaysia - Kuala Lumpur (The Association of Banks in Malaysia, 2016). On average, small banks operate only three branches, against 152 branches operated by large banks. The apparently unbalanced distribution of branch locations reveals the fact that the incumbent small banks in Malaysia generally target a market based on high value corporate clients, as opposed to the the mass and corporate customers served by the large, geographically diversified banks (BNM, 2001). In terms of the number of bank branches to the number of the population, the urban areas of Malaysia are highly concentrated with bank institutions, while certain rural areas remain underserved (BNM, 2001).

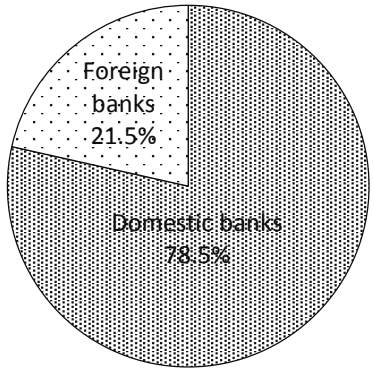
Figure 2.2 Breakdown of bank market shares by bank ownership as at the end of 2015

(a) Breakdown of bank assets by bank ownership



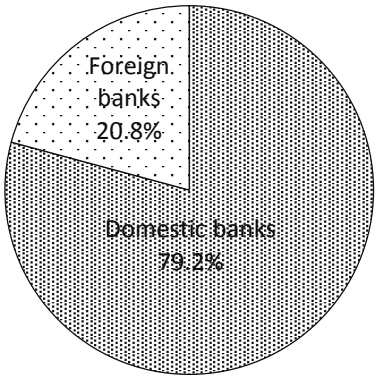
Total assets:
MYR 2,303 billion

(b) Breakdown of bank loans by bank ownership



Total loans:
MYR 1,417 billion

(c) Breakdown of bank deposits by bank ownership



Total deposits:
MYR 1,648 billion

Source: BNM website (http://www.bnm.gov.my/) and author's calculations

Although the Malaysian government does not have a direct ownership in domestic banks, it has been a major player in the banking system through seven principal government-linked investment companies (GLICs), such as the Employees Provident Fund (EPF), Retirement Fund Incorporated (KWAP), Sovereign Wealth Fund Institute (Khazanah), Permodalan Nasional Berhad (PNB), PNB Managed Unit Trusts, Armed Forces Fund Board (LTAT) and Boustead Holdings Berhad[6] (IMF, 2014; World Bank, 2013). Table 2.2 shows that these GLICs have the largest share blocks in Maybank, CIMB Group, RHB Capital Berhad and Affin Holdings Berhad, between 46 and 65 percent of total shareholdings of the banks in the year 2013. The GLICs also held the shares of the remaining four domestic banking groups by up to 16 percent. Despite the government allegedly not interfering with the management of the domestic banks and despite all the banks being subject to the same regulation standards, products offered by government-linked banks may carry a perceived implicit guarantee that may lead to an imbalanced development of the financial system and economic sectors (IMF, 2014; World Bank, 2013).

[6](i) The EPF is a government agency under the Ministry of Finance which manages the compulsory savings plan and provides retirement benefits for legally employed workers in Malaysia (http://www.kwsp.gov.my/portal/en/web/kwsp/home).
(ii) Retirement Fund Incorporated refers to Kumpulan Wang Persaraan (Diperbadankan) (KWAP), an agency established on 1 March 2007 under the Ministry of Finance to manage pension funds on behalf of the federal government (http://www.kwap.gov.my/en).
(iii) Khazanah is the investment holding arm of the government entrusted to hold and manage the commercial assets of the government and to undertake strategic investment (http://www.khazanah.com.my/Home).
(iv) PNB was established on 17 March 1978 as a pivotal instrument of the Government's New Economic Policy to promote share ownership in the corporate sector among the Bumiputera (son of the soil), and to develop opportunities for deserving Bumiputera professionals to participate in the creation and management of wealth (http://www.pnb.com.my/).
(v) PNB managed unit trusts comprise various unit trusts such as Bumiputera fund and Vision 2020 fund (http://www.pnb.com.my/).
(vi)The Malaysian Armed Forces Fund Board refers to Lembaga Tabung Angkatan Tentera (LTAT), a government statutory body incorporated in 1973 to provide retirement benefits and other benefits to members of other ranks in the armed forces and a savings scheme for officers of the armed forces and members of volunteer forces (http://www.ltat.org.my/webltat/index.html).
(vii) Boustead Holdings Berhad is a government-linked investment holding company that has an active interest in six primary sectors of the Malaysian economy, namely plantation, property, pharmaceuticals, heavy industries, trading and industrial, and finance and investment. Its largest shareholder is LTAT (http://www.boustead.com.my/).

Table 2.2 Shareholding by Government-Linked Institutions and Funds (GLICs)

Banking Groups	Principal GLCs (% of equity held)	Total % of equity held
Affin Holdings Berhad	LTAT (35.2); Boustead (20.7); EPF (7.9)	63.8
Alliance Financial Group	EPF (14.4); KWAP (0.58)	15.0
AmBank Group	EPF (14.1); KWAP (0.77)	14.9
CIMB Group	EPF (16.9); Khazanah (28.31); KWAP (3.36); LTAT (0.33)	48.9
Hong Leong Group	EPF (1.11); EPF (14.9); KWAP (0.58)	16.6
Maybank	EPF (14.11); PNB Managed Unit Trust (42.34); PNB (5.68); KWAP (1.99); LTAT (0.61)	64.73
Public Bank Berhad	EPF (14.8); KWAP (0.62)	15.41
RHB Capital Berhad	EPF (41.3); KWAP (3.78); LTAT (0.58)	45.7

Source: Banking groups' annual reports for the financial year 2013

To ensure monetary and financial stability in the country, BNM has consistently reviewed the effectiveness of the existing regulations on banking institutions and implemented regulatory reforms in accordance with domestic financial development and international standards. Important regulatory frameworks introduced or amended by BNM after the country recovered from the Asian crisis in the late 1990s include:

(i) The New Liquidity Framework which took effect from 2 January 2001 to 1 June 2015 (BNM, 2016a). The New Liquidity Framework was developed in 1998 to replace the previous liquid asset ratio requirement and offer a more effective way for banking institutions to measure and manage their liquidity position in meeting all maturing obligations[7] (BNM, 1998a). For commercial banks, the framework requires the banks to classify all balance sheet items and off-balance sheet items into six maturity buckets of "less than a week", "between a week to a month", etc., until the last bucket of "greater than a year". To ensure banks hold sufficient liquidity to survive an acute stress scenario lasting a month, the framework also required commercial banks to maintain a minimum surplus liquidity of three percent of the net maturity mismatch for the "one week" bucket and five percent of the net maturity mismatch for the "one week to one month" bucket (BNM, 1998a). Effective from 1 June 2015, the New Liquidity Framework has been superseded by the Basel Accord III liquidity coverage ratio to strengthen the existing liquidity framework for the Malaysian banking sector (BNM, 2012).

[7] The liquid asset ratio required commercial banks to hold a minimum of 17 percent of their eligible liabilities (BNM, 1998b).

(ii) The New Interest Rate Framework which was introduced on 26 April 2004 (BNM, 2005). The most significant change brought by the framework to the domestic monetary operations was the introduction of a new policy rate of BNM, or known as the Overnight Policy Rate (OPR). OPR is a key monetary policy instrument that allows BNM to quickly transmit its monetary policy stance to other market rates and ultimately to macroeconomic variables. This implies that, with OPR, BNM can effectively manage liquidity creation for private sector activity while maintaining monetary stability and inflationary pressure in the economy. To reflect the unchanged stance of BNM's monetary policy, OPR was set at the prevailing overnight interbank rate of 2.70% at its introduction (BNM, 2005). The New Interest Rate Framework also involved the removal of the ceiling on the base lending rates (BLR) of banking institutions, as part of the pricing deregulation initiatives under the FSMP[8]. The removal of the ceiling on BLR enhances the efficiency of banking institutions in the pricing and allocation of resources based on their respective cost structures and business strategies (BNM, 2005).

(iii) Statutory Reserve Requirement (SRR) is another monetary policy instrument of BNM that influences liquidity and credit creation by the banking system (BNM, 2011b). Depending on the liquidity condition in the banking system, the SRR rate is adjusted from time to time. The current SRR rate is 3.5 percent effective from 1 February 2016 (BNM, 2016b). Literally, all banking institutions are required to maintain balances equivalent to the SRR ratio times the average daily amount of eligible liabilities over a fortnight in their Statutory Reserve Accounts (SRA) with BNM[9]. The SRA balance of banks is, nevertheless, allowed to fluctuate daily within a band, currently at 20% of the prevailing SRR rate, giving the banks flexibility to manage their liquidity (BNM, 2016b).

(iv) The Deposit Insurance System (DIS) was brought into effect in Malaysia in September 2005 and managed by an independent statutory body called the Malaysia Deposit Insurance Corporation (MDIC) under the Malaysia Deposit Insurance Corporation Act 2005 (BNM, 2006). The establishment of DIS aims to strengthen the consumer protection framework in Malaysia and complement the roles of BNM in preserving public confidence in the financial system by providing explicit insurance against the loss of insured deposits placed with member banks should a member bank fail (BNM, 2006; PIDM, 2016). Currently, all commercial and Islamic banks, including locally incorporated foreign banks, are member institutions of MDIC (PIDM, 2016). Under DIS, all types of depositors,

[8] Base Lending Rate (BLR) refers to the lending rates that commercial banks and Islamic banks quote to their best customers (BNM, 2016a).

[9] Eligible liabilities include almost all liabilities in a bank and exclude eligible assets such as deposits placed with domestic banking institutions. See Appendix 4 of BNM (2011b) for a comprehensive measurement of eligible liabilities.

regardless of whether they are businesses or individuals, are protected up to MYR 250,000 per depositor per member bank, inclusive of both principal amount of deposits and interest. DIS also provides separate coverage for both conventional and Islamic deposits. With the MYR 250,000 limit, 99% of depositors are protected in full (PIDM, 2016).

Besides, the regulatory framework for the Malaysian banking sector is strongly incorporated with the elements of the global regulatory framework developed by the Basel Committee on Banking Supervision (Basel Committee). In December 2010, the Basel Committee introduced a package of bank-level reform measures for capital and liquidity (collectively referred to as Basel III) with the ultimate goal of strengthening the regulation, supervision and risk management of the banking sector (Bank for International Settlements, n.d.). BNM is strongly supportive of the implementation of Basel III standards in Malaysia and has managed the transition of the capital and liquidity standards for Malaysian banking institutions towards Basel III following the Basel Committee's recommended phase-in timeline, as outlined in Table 2.3 (BNM, 2012). The minimum capital and conservation buffer requirements for Malaysian banking institutions have been gradually raised in line with the phase-in arrangements of Basel III. Likewise, with the revised definition of high quality regulatory capital, all capital instruments that are no longer compliant with Basel III are subject to a gradual phasing-out by 2023. Besides, prior to the formal implementation of Basel III's standards for leverage ratio, liquidity coverage ratio and net stable funding ratio in Malaysia, BNM has implemented an "observation period" commencing from June 2012. During the "observation period", banking institutions are required to report their capital, leverage and liquidity positions calculated according to Basel III rules to BNM, which then comprehensively assesses the impact of these Basel III's standards and fine-tunes the transitional arrangements of these standards in the banking sector (BNM, 2012). Based on the current profiles of banking institutions, all banking institutions are expected to comfortably meet the Basel III's capital and liquidity requirements by the expected implementation dates[10] (BNM, 2012).

[10] Profiles of banking institutions may refer to risk position and management as well as financial performance and position of banking institutions (BNM, 2012).

Table 2.3 Basel III phase-in arrangements in Malaysia[a]

	2012	2013	2014	2015	2016	2017	2018	2019
Leverage Ratio	Observation period reporting						Minimum 3%	
Minimum common equity capital ratio		3.50%	4%	4.50%	4.50%	4.50%	4.50%	4.50%
Capital conservation buffer					0.625%	1.25%	1.875%	2.50%
Minimum common equity plus conservation buffer		3.50%	4%	4.50%	5.125%	5.75%	6.375%	7%
Minimum tier 1 capital		4.50%	5.50%	6%	6%	6%	6%	6%
Minimum tier 1 capital plus conservation buffer		4.50%	5.50%	6%	6.63%	7.25%	7.875%	8.50%
Minimum total capital		8%	8%	8%	8%	8%	8%	8%
Minimum total capital plus conservation buffer		8%	8%	8%	8.63%	9.25%	9.875%	10.50%
Capital instruments that no longer qualify as non-core tier 1 or tier 2 capital		Phased out over a 10 year horizon beginning 2013						
Liquidity coverage ratio	Observation period reporting			60% from June	70%	80%	90%	100%
Net stable funding ratio	Observation period reporting						Minimum 100%	

Note:

[a] All dates are as of 1 January unless otherwise indicated. Shaded areas indicate transition periods.

Source: Adapted from BNM (2012) and BNM website (http://www.bnm.gov.my/)

2.3 Overview of the Malaysian stock market

Malaysia has a single stock exchange that is currently regulated and operated by Bursa Malaysia (formerly known as the Kuala Lumpur Stock Exchange (KLSE)). Bursa Malaysia is an exchange holding company established in 1973 when the Stock Exchange of Malaysia and Singapore was split into two exchanges, with the other exchange being the Stock Exchange of Singapore (Bursa Malaysia, 2015a; Tan, 2000). Today, Bursa Malaysia operates a fully-integrated exchange, offering a diverse range of investment products covering equities, derivatives, bonds, Islamic products and offshore financial exchange (Bursa Malaysia, 2016). Its core operations such as exchange operations, clearing, settlement and depository operations and information services, are run by various subsidiary companies. The three main market institutions in the stock market are Bursa Malaysia Securities Berhad, Bursa Malaysia Securities Clearing Sdn. Berhad and Bursa Malaysia Depository Sdn. Berhad. Bursa Malaysia Securities Berhad regulates and operates the listing and trading activities of shares; Bursa Malaysia Securities Clearing Sdn. Berhad (formerly Securities Clearing Automated Network Services Sdn. Bhd. - SCANS) is the central counterparty that clears and settles share trades, while Bursa Malaysia Depository Sdn. Berhad (formerly the Malaysian Central Depository Sdn. Bhd. - MCD) operates and maintains the Central Depository System (CDS) by approving and facilitating the electronic transfer of securities from one CDS account to another (Bursa Malaysia, 2016).

The Malaysian stock exchange is order-driven, which means that the prices at which orders are matched are determined by market forces of supply and demand through a process of bids and offers by investors (Bursa Malaysia, 2015b). Six types of orders are allowed under the current electronic trading platform, which are limit order, market order, market to limit order, fill and kill order, market fill order and kill and minimum quantity order (Bursa Malaysia, 2015b). The execution of investors' orders on the platform is facilitated by 30 stockbroking firms (or Participating Organisations) who act on the behalf of client investors (Bursa Malaysia, 2015a). As part of the Bursa Malaysia technology refresh programme, the trading platform of the stock market has been consistently upgraded to keep the exchange on a par with the performance and capabilities of the leading stock exchanges (Bursa Malaysia, 2013). The latest trading engine in the stock market, Bursa Trade Securities (BTS2), is powered by NASDAQ OMX's X-stream and was launched on 2 December 2013. The launch of BTS2 provides the necessary headroom for the market to attract a greater variety of market participants and trade volume, while enhancing trading experience in terms of innovative products and services, efficient trading and transparency (Bursa Malaysia, 2013; NASDAQ, 2013). Previous trading engines used in the stock market are: (i) BTS developed by NYSE Euronext and launched in the market on 1 December 2008, and (ii) SCORE (System on Computerised Order

Routing and Execution) which was semi-automated when first launched in 1989 and was upgraded to a fully automated system in 1992 (Tan, 2000).

To facilitate efficient delivery and settlement of trades and to minimise investors' risk exposure, Bursa Malaysia has established a T+3 Rolling Settlement System for the stock market (Bursa Malaysia, 2015b). The term T+3 indicates that the delivery and settlement for transactions is 3 trading days after the transaction date (T). Two electronic settlement models offered are the Bursa Depository Transfer system and the Institutional Settlement Service (ISS) system (LuxCSD, 2015). Under the Bursa Depository Transfer system, settlement of stock transfer is made between brokers and custodians via the CSD, and payment of transactions is made between brokers and custodians via interbank payment or cheque. ISS is an optional settlement system offered by Bursa Malaysia Securities Clearing Sdn. Berhad (Bursa Clearing) to facilitate settlement of trades of institutional investors through non-trading clearing participants (NTCP) who clear and settle directly with Bursa Clearing on a delivery-versus-payment basis. To initiate ISS settlement, stock brokers have to request ISS settlement via the ISS system from T+1 onwards. On T+3, delivery of securities and payment for transactions are made directly between Bursa Clearing and the buying and selling NTCP (Bursa Malaysia, 2015b; LuxCSD, 2015).

To extend the global relevance, recognition and reach of the stock market, on 26 June 2006, Bursa Malaysia Limited joined forces with FTSE Group, a leading global index provider (Bursa Malaysia, 2006). The joint venture has continuously seen the conversion of the existing stock indices onto the FTSE global index standards and the launch of new FTSE Bursa Malaysia indices into the index series, in efforts to provide investors with better tools to benchmark the performance of the major capital and industry segments of the Malaysian stock market and regional markets and to drive index-based product innovation such as ETFs, structured products and index tracking funds (Bursa Malaysia, 2015c). Presently, FTSE Bursa Malaysia Index Series consist of a broad range of all cap, large cap, mid cap, small cap, fledgling, Sharia-compliant and themed series, covering all eligible companies listed on the Bursa Malaysia Main and ACE Markets provided that they meet the FTSE international standards of free float, liquidity and investability[11] (Bursa Malaysia, 2015c; FTSE, 2015). The FTSE Bursa Malaysia KLCI, which was previously known as KLCI before adoption of the FTSE global index standard on 6 July 2009, is the main index for the Malaysian stock market that reflects the overall market performance and investors' expectations of macro- and micro-economic outlooks (Bursa

[11] Refer to Bursa Malaysia (2015c) for detailed information about individual FTSE Bursa Malaysia indexes.

Malaysia, 2015c). The FTSE Bursa Malaysia KLCI comprises the 30 largest companies listed on the Main Market by market capitalisation (Bursa Malaysia, 2015c).

In addition, the minimum tick size structure of Bursa Malaysia is in line with the current practice of global developed markets (Bursa Malaysia, 2009). The tick size was reduced on 3 August 2009 to make future stock price movements more predictable, reduce the transaction costs of investors and enhance market depth, breadth and resiliency, thereby increasing the stock market liquidity (Bursa Malaysia, 2015b). Except for equity-based ETFs, all listed securities traded on Bursa Malaysia are subject to the same tick size structure. Table 2.4 compares the previous and current minimum tick size structure of Bursa Malaysia. For illustration, a MYR 5.60 stock would be quoted in multiples of five cents under the old tick size regime, which means that the next tick up would be MYR 5.65 and the next tick down would be MYR 5.55. In contrast, the current tick size regime reduces the minimum price movement of the stock by observing a MYR 5.60 stock rising to the next tick which is MYR 5.61 or falling to the next tick which is MYR 5.59.

Table 2.4 Tick sizes for securities traded and quoted on Bursa Malaysia

Securities Price	Previous Tick Size (cents)	Current Tick Size (cents)
Below MYR1.00	0.5	0.5
MYR1.00 to MYR2.99	1	1
MYR3.00 to MYR4.99	2	
MYR5.00 to MYR9.99	5	
MYR10.00 to MYR24.99	10	2
MYR25.00 to MYR99.98	25	
MYR100.00 and above	50	10

Source: Bursa Malaysia (2015b)

Besides the cost of shares bought or sold, investors bear the transaction costs of trading on Bursa Malaysia which encompass commissions charged by brokers, stamp duty and clearing fees (Bursa Malaysia, 2015b). In Malaysia, capital gain tax is not imposed on investors from the sale of financial securities, and non-Malaysian residents are not subject to withholding tax on dividends paid on domestic equities (Deloitte Touche Tohmatsu Limited, 2015).

Today, the Malaysian stock market is one of the largest bourses in ASEAN (Bursa Malaysia, 2015a). As at the end-year 2015, the stock market hosted 903 listed companies across 18 sectors that covered 60 economic activities, of which 794 companies were listed on the Main Market and 109

companies on the ACE Market[12] (Bursa Malaysia, 2015d). The Main Market provides an ideal platform for established companies to raise funds by issuing claims on ownership in the company, while the ACE Market is an alternative sponsor-driven market designed for smaller and younger companies with growth potential from all business sectors[13] (Bursa Malaysia, 2015e). Besides share issuances, companies can also issue equity-based securities on the market, such as structured warrants, exchange traded funds (ETFs), Real Estate Investment Trusts (REITs) and stapled securities, in order to improve the diversification exposure, value and attractiveness of the securities to investors (Bursa Malaysia, 2015a).

The stock market is predominantly played by domestic investors. As at end-year 2015, the total stock market capitalisation was valued at MYR 1.7 trillion of which domestic investors claimed about 78 percent (Bursa Malaysia, 2015a). The major investors in the market are domestic institutional investors (mutual funds, unit trusts, provident and pension funds and insurance companies) who traded about 50 percent of total share trading value of MYR 512 billion in 2015. Whereas, domestic retail investors and foreign institutions constituted about 23 percent and 27 percent, respectively, of the total share trading value. Besides, the growth in the amount of investor participation of in the market has been robust, as evidenced by 153,140 CDS accounts opened in 2015[14] (Bursa Malaysia, 2015a).

2.4 Financial and monetary development

This section briefly reviews the financial and monetary conditions of Malaysia since the year 2001 and compares the developments across the national border against its ASEAN peers.

2.4.1 Domestic financial and monetary development

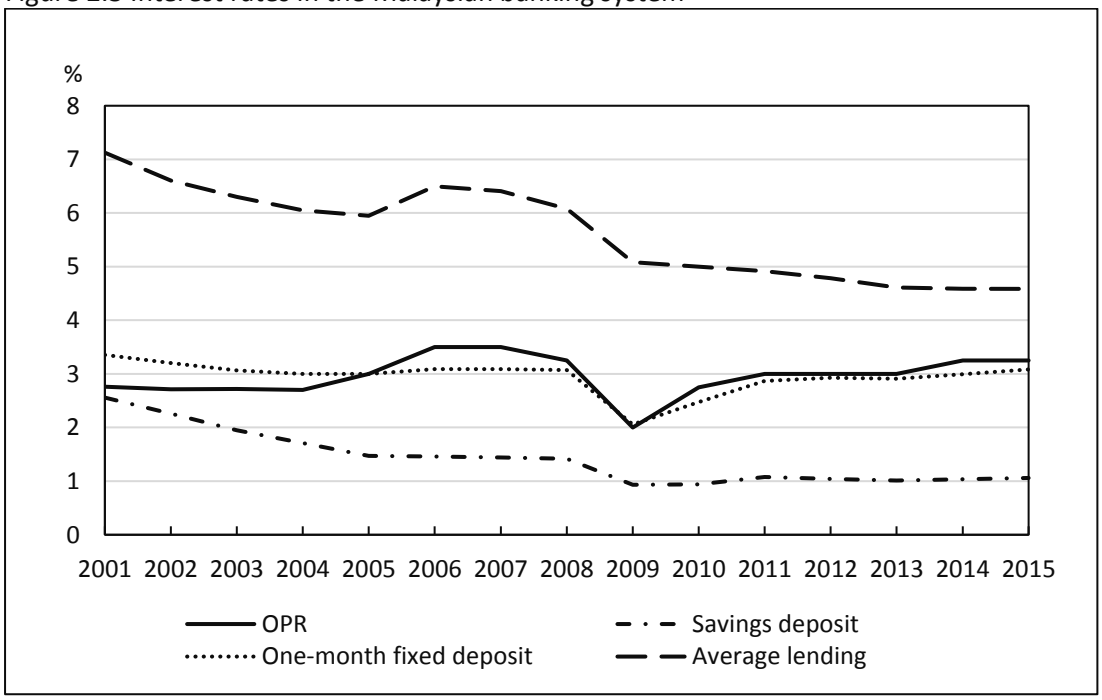
Domestic interest rates in the Malaysian banking system have demonstrated considerable changes in the past 15-year span, as shown in Figure 2.3. BNM's OPR demonstrated an upwards movement from 2.76 percent in 2001 to 3.50 percent in 2007 after which the OPR was reduced sharply to two percent during the 2008 global financial crisis. The OPR returned to pre-crisis levels and reached 3.25 percent at the end-year 2015. The rapid rise in OPR before the crisis reflects strong domestic

[12] From 3 August 2009, the Main and Second Boards of Bursa Malaysia were unified into the Main Market, while the ACE market which stands for "Access, Certainty and Efficiency" was renamed after the MESDAQ (Malaysian Exchange of Securities Dealing and Automated Quotation) market (Bursa Malaysia, 2015d).
[13] Refer to Bursa Malaysia (2015e) for qualitative and quantitative listing criteria on the Main Market and ACE Market.
[14] Investors who wish to trade in securities listed on Bursa Malaysia market must open CDS accounts with Authorised Depository Agents that are stockbroking companies (Bursa Malaysia, 2015b).

economic growth and price development. Substantial cuts in OPR during the financial crisis years 2008 and 2009 were the thrust of the BNM's monetary policy to boost domestic demand during the crisis. OPR was soon raised after the financial crisis to normalise monetary conditions to prevent the risk of imbalanced financial developments that could undermine the economic recovery. Figure 2.3 also shows that average one-month fixed deposit rates set by commercial banks ranged from 2.06 percent to 3.35 percent from the years 2001 to 2015 and followed the movement in OPR, although its changes were not as substantial as OPR's. Saving depositors with commercial banks also benefited from positive savings rates throughout the period. Despite the rebound of OPR after the financial crisis, the average lending rate on outstanding loans declined slightly and has remained broadly stable in recent years, implying improving credit worthiness of borrowers.

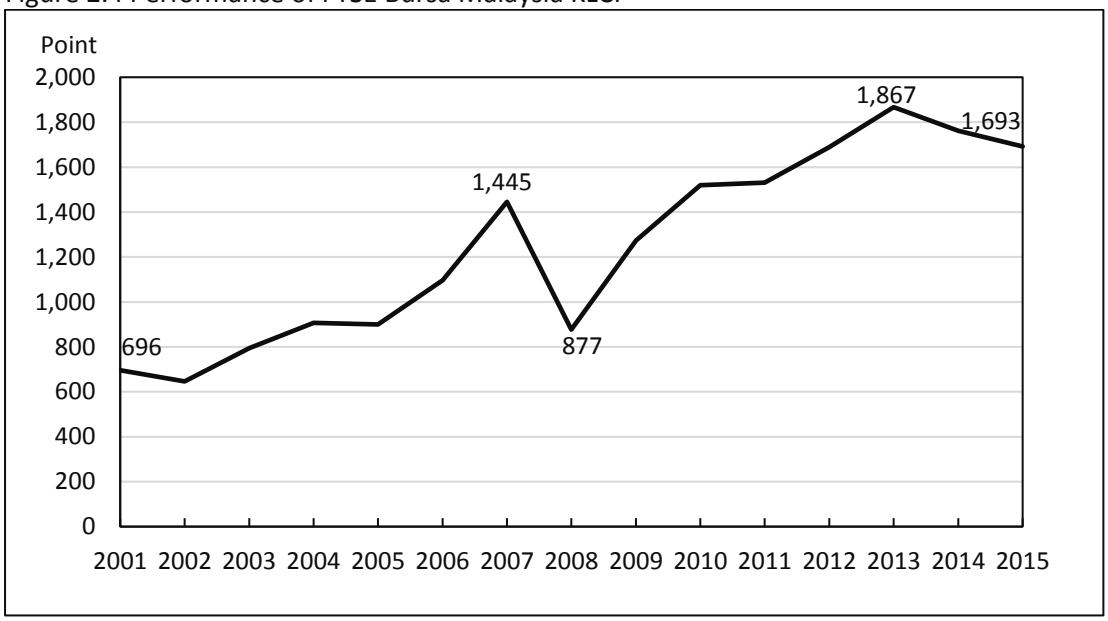
Besides the accommodative interest environment of the banking system, the domestic stock market performed considerably well from the year 2001 to the year 2015, as shown in Figure 2.4. The FTSE Bursa Malaysia KLCI grew at an annual average rate of 8.6 percent from 696 points to 1,693 points over the past 15 years. The underperformance of the stock market in the year 2008, and in the recent two years, was mainly and inevitably a result of global economic and financial uncertainties, such as the 2008 global financial crisis and the plunge in global oil prices in 2015 – evidence that the Malaysian economy and its financial system are internationally connected.

Figure 2.3 Interest rates in the Malaysian banking system



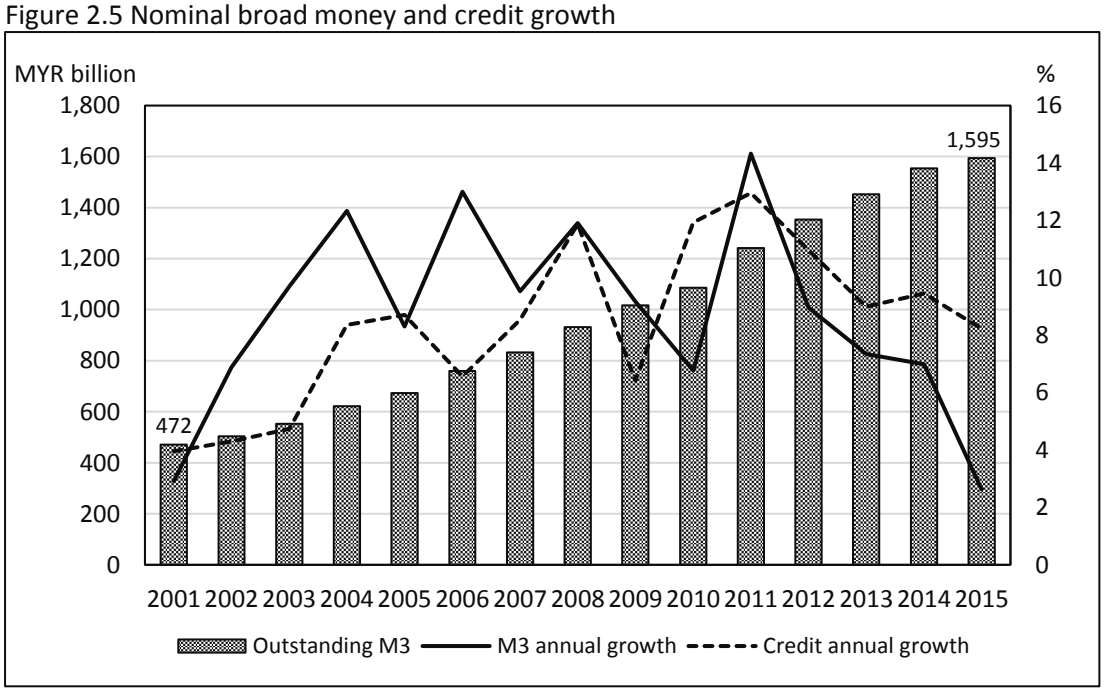
Source: BNM website (http://www.bnm.gov.my/)

Figure 2.4 Performance of FTSE Bursa Malaysia KLCI



Source: BNM website (http://www.bnm.gov.my/)

Figure 2.5 Nominal broad money and credit growth



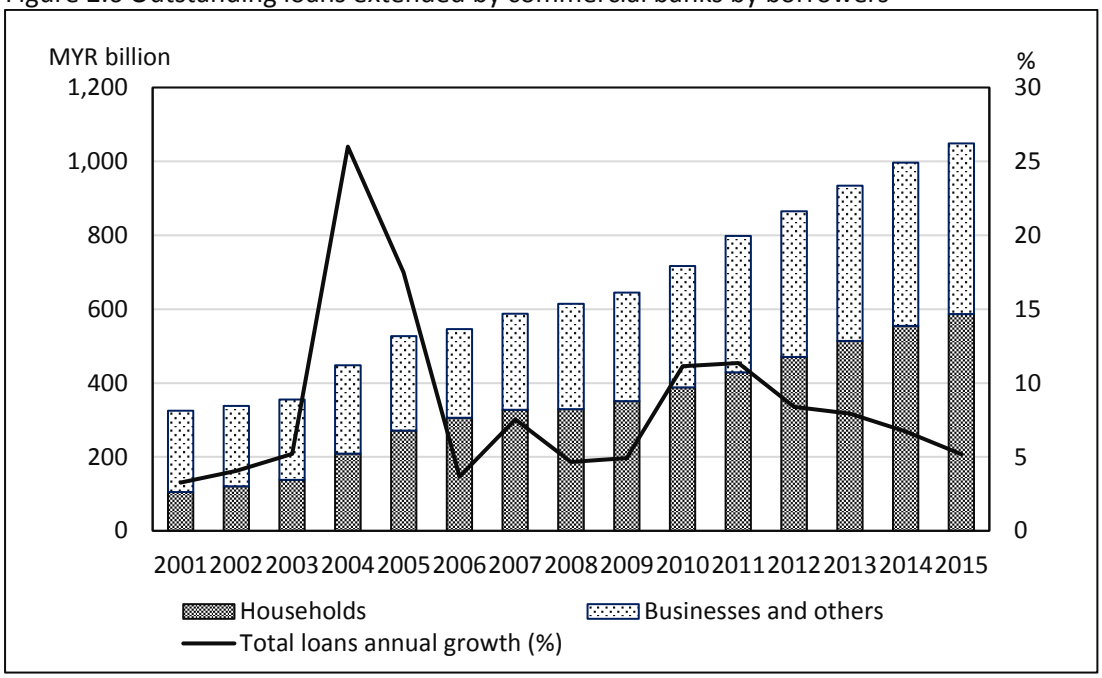
Source: BNM website (http://www.bnm.gov.my/)

M3 is a useful empirical indicator of the broad monetary aggregate in the non-bank sector as it has a greater capability to indicate monetary and financial market liquidity as compared to narrower monetary aggregate indicators (ECB, 2012)[15]. In Malaysia, the broad money (M3) is mainly driven by claims on the private sector in the form of bank loans. Figure 2.5 shows the broad money and credit growth in Malaysia from the year 2001 to the year 2015. It appears that the overall monetary condition was favourable in supporting private sector activities. Nominal broad money (M3) grew rapidly from MYR 472 billion in 2001 to MYR 1,595 billion in 2015 at an annual average rate of 8.5 percent. Aggregate credit growth had tended to move closely in line with M3 growth, with a noticeably upward trend, possibly reflecting strong increases in the financial intermediation process. Aggregate credit grew at an average of 8.1 percent per annum over the same time span.

Looking closely at the conventional offerings by commercial banks, Figure 2.6 shows that outstanding loans extended by commercial banks grew at about 8.1 percent annually from MYR 325 billion to MYR 1,048 billion over the past 15 years. The lending to individuals and households has been increasing and has outstripped business enterprises and other borrowers since the year 2005 and constituted about 56 percent of the total outstanding loans at the end-year 2015. Besides, deposits placed by individuals occupied almost half of the total deposits placed with commercial banks, as displayed in Figure 2.7. Deposits of individuals are mostly in the forms of savings and fixed deposit contracts. Business enterprises contributed second most to the total deposits placed with commercial banks, usually in the form of demand deposits. Total bank deposits rose at an average rate of 8.7 percent annually from MYR 350 billion to MYR 1,228 billion over the period from 2001 to 2015. Figures 2.6 and 2.7 both indicate sharp rises in loans and deposits at commercial banks in the year 2004, which were mainly attributed to a high real GDP growth rate of seven percent, a facilitative monetary environment and rising consumer and business confidence.

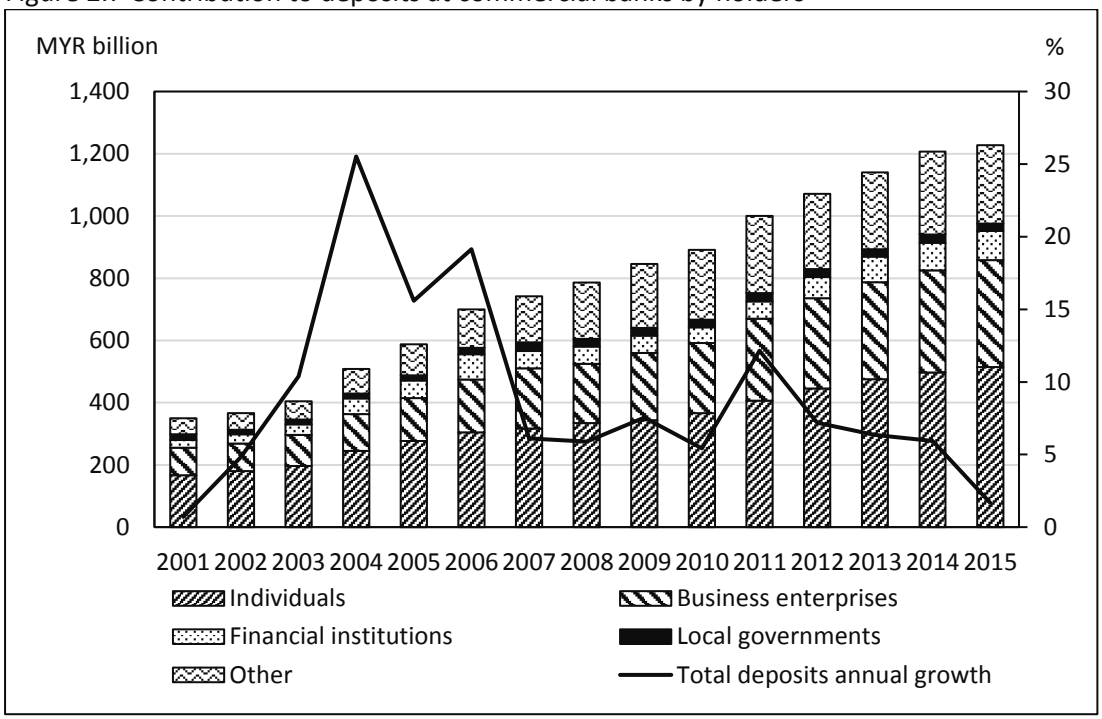
[15] In Malaysia, monetary aggregates are categorised into M1 that comprises currency in circulation and demand deposits, M2 comprises M1 and narrow quasi-money (interest-bearing deposits placed by the non-bank sector with commercial banks and Islamic banks), and M3 comprises M2 and deposits placed by the non-bank sector with investment banks (BNM, 2016a).

Figure 2.6 Outstanding loans extended by commercial banks by borrowers



Source: BNM website (http://www.bnm.gov.my/)

Figure 2.7 Contribution to deposits at commercial banks by holders

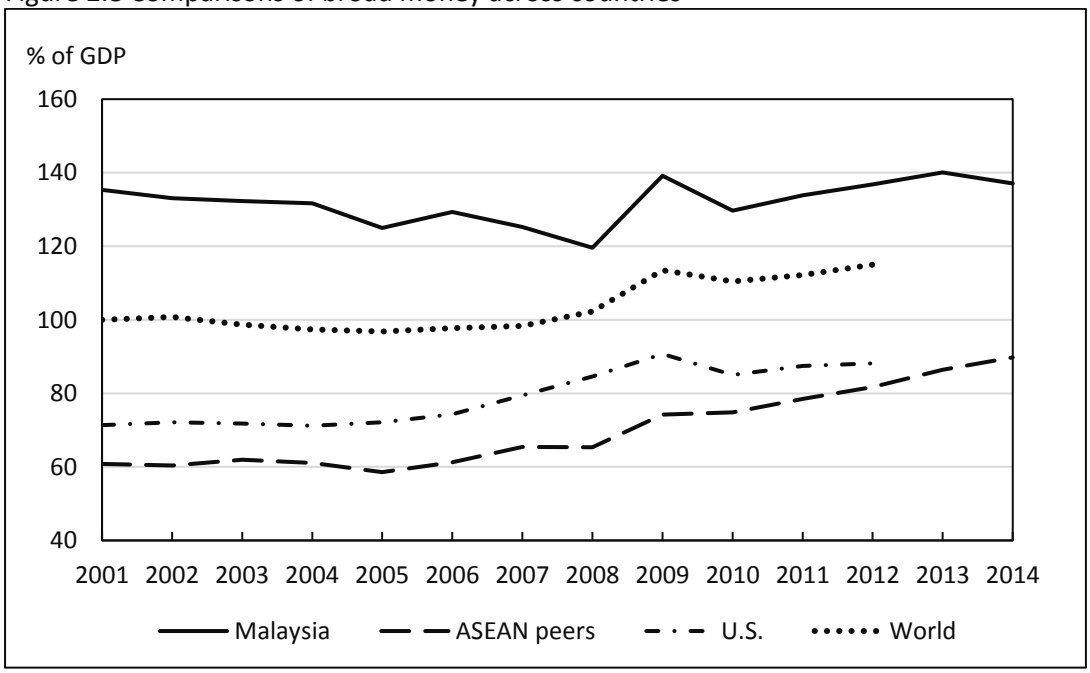


Source: BNM website (http://www.bnm.gov.my/)

2.4.2 Cross-country comparisons of financial system development

This section specifically compares the depth of broad money, bank lending, bank deposits and stock market capitalisation and turnover of Malaysia with its ASEAN peer average, the U.S. and the world averages. Figure 2.8 indicates that the liquidity condition in Malaysia was most ample in comparison with its ASEAN peer average, the U.S. and the world averages. The monetary liquidity available for the Malaysian private sector was consistently greater than the domestic economic output by 1.2 to 1.4 times throughout the period from 2001 to 2014. In contrast, the liquidity condition of the average ASEAN countries was relatively scarce, despite the apparent growth in recent years. The broad money of the average ASEAN countries was about 70 percent of their GDP on average from 2001 to 2014.

Figure 2.8 Comparisons of broad money across countries



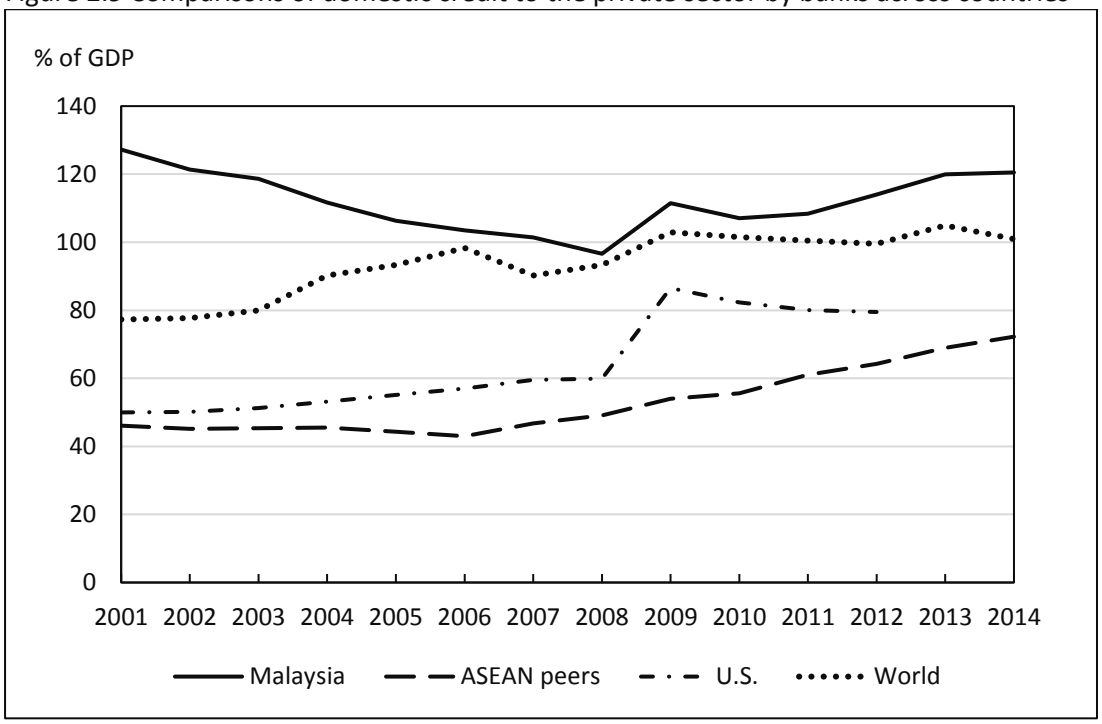
Note: Due to data availability, ASEAN peers comprise Brunei, Cambodia, Indonesia, Lao PDR, Philippines, Singapore, Thailand and Vietnam.
Source: The World Bank database

Figure 2.9 shows the financial depth, as approximated by private credit extended by banks as a percentage of GDP, across countries. It is apparent that the banking sector of Malaysia is relatively deeper compared to the world average and the ASEAN countries in general, revealing the fact that the reliance on bank credit by the private sector in Malaysia for generating economic outputs is more substantial than other nations, in general. The average private credit extended by the banks of Malaysia was about 1.12 times greater than the domestic GDP, and its pattern was closely similar to the pattern of broad money. The banking sector of the U.S. was not as deep as Malaysia's, partly

because of the U.S.'s market-oriented financial system. Furthermore, the exceedingly above international average of Malaysia's bank deposits to GDP ratio, as demonstrated in Figure 2.10, again, confirms the importance of the financial intermediation role of domestic banks in Malaysia.

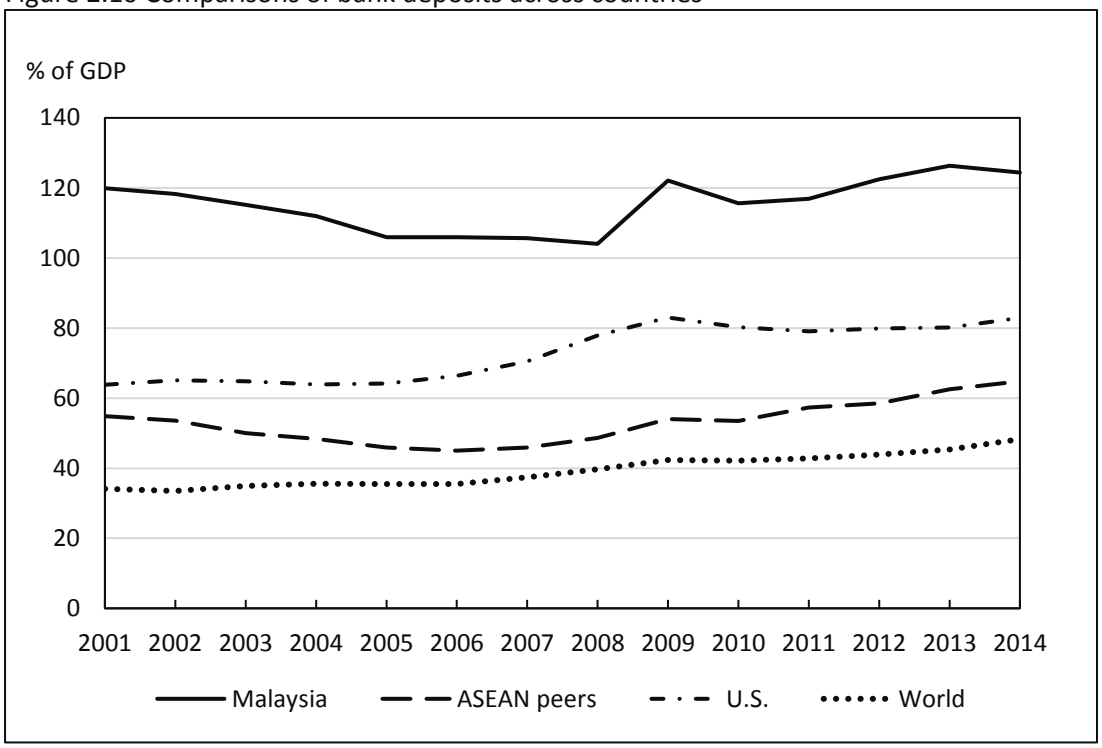
Figure 2.11 and Figure 2.12 reveal an interesting fact about the stock market development in Malaysia, that is, Malaysia has had the largest but most inactive stock market among the countries in comparison. Such a phenomenon is rare because capital market size should be positively correlated with market turnover, as typically presented by the U.S.'s stock market. Theoretically, a large capital market is more attractive to investors as the market enhances the ability of investors to mobilise capital and diversify risk (Demirgüç-Kunt & Levine, 1996a). Further, both Figure 2.11 and 2.12 indicate that stock markets worldwide were heavily affected by the 2008 global financial crisis, reflecting financial contagion in today's globalised and integrated financial system. At the end of 2008, the world average stock market capitalisation collapsed by about 50 percent from the previous year, while the trading turnover of stock markets worldwide was recorded as unprecedentedly high, as a wave of panic selling of devaluating shares swept the globe (Wearden & Kollewe, 2008).

Figure 2.9 Comparisons of domestic credit to the private sector by banks across countries



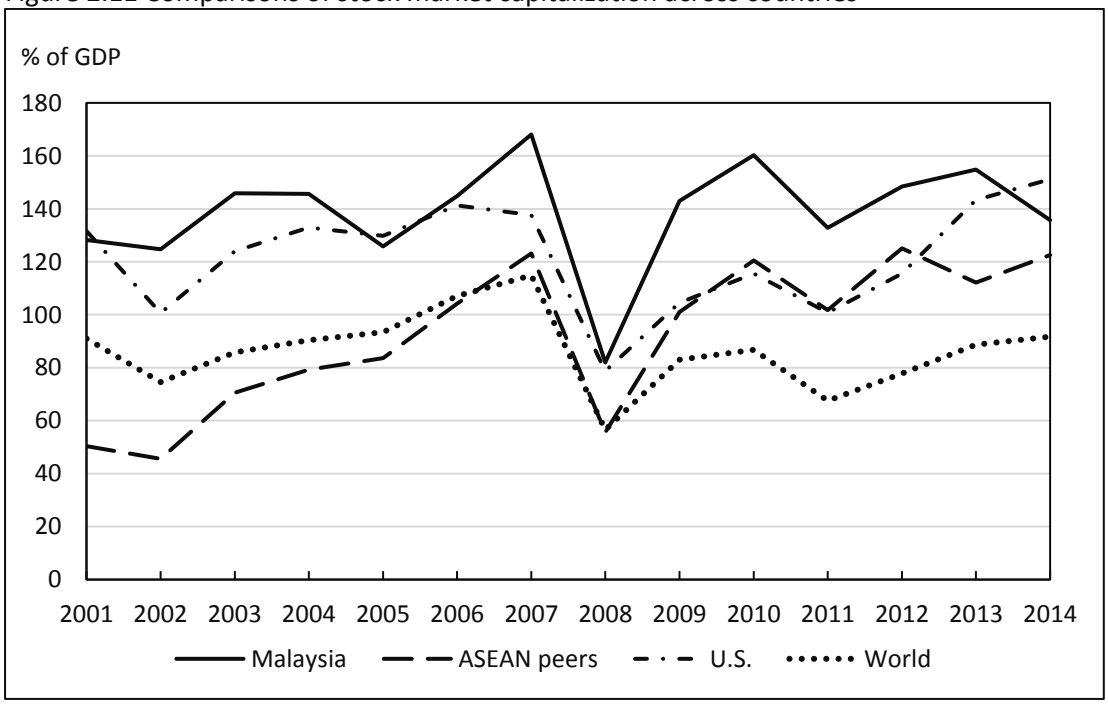
Note: Due to data availability, ASEAN peers comprise Brunei, Cambodia, Indonesia, Lao PDR, Philippines, Singapore, Thailand and Vietnam.
Source: The World Bank database

Figure 2.10 Comparisons of bank deposits across countries



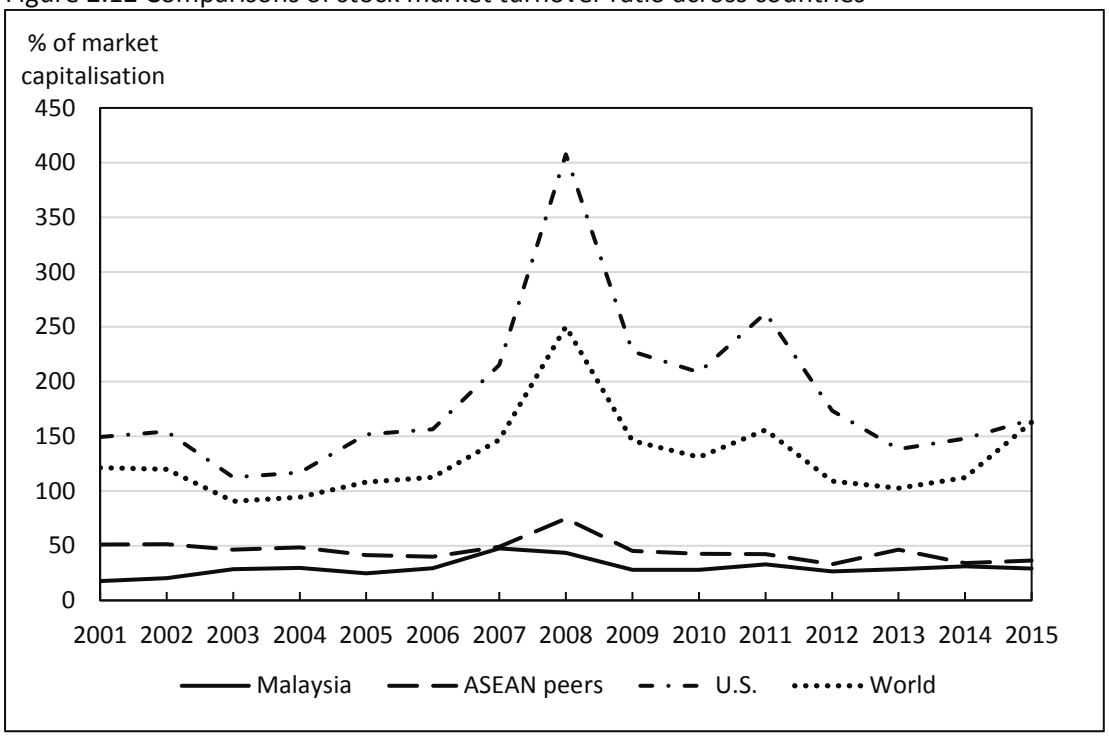
Note: Due to data availability, ASEAN peers comprise Brunei, Cambodia, Indonesia, Lao PDR, Philippines, Singapore, Thailand and Vietnam.
Source: The World Bank database

Figure 2.11 Comparisons of stock market capitalization across countries



Note: Due to data availability, ASEAN peers comprise Indonesia, Philippines, Singapore and Thailand.
Source: The World Bank database

Figure 2.12 Comparisons of stock market turnover ratio across countries



Note: Due to data availability, ASEAN peers comprise Indonesia, Philippines, Singapore and Thailand.
Source: The World Bank database

2.5 Chapter summary

This chapter provides an overview of the Malaysian banking system and stock market and highlights the financial system development in Malaysia in relation to its ASEAN peers, the world average and the U.S. The financial system in Malaysia has been highly bank-oriented with the domestic banking sector provides about half of new private financing each year. Since the Malaysian economy recovered from the 1997 Asian financial crisis, the financial system has undergone a series of progressive, phased financial sector and capital market reforms with the ultimate objective of developing a resilient, competitive and dynamic financial system with internationally compliant best practices. Unlike other countries, the development of a competitive banking sector in Malaysia is not only influenced by economic, technological and regulatory factors, but also by the uprising of Islamic banks which challenge the dominance of commercial banks in the liquidity creation market. Further, the Malaysian stock market is internationally integrated and large but has been illiquid for a long time, which sets out a unique context to study the influence of stock market liquidity on bank liquidity creation in the Malaysian bank-based financial system.

Chapter 3

Literature Review

3.1 Introduction

This chapter provides a review of bank liquidity creation theories and prior studies relevant to the three main research objectives of this study. Section 3.2, first, explains bank liquidity creation from a standard perspective, and briefly reviews some famous bank liquidity creation theories that have evolved with the development of financial systems. Section 3.3 provides a literature review of the impact of bank competition on bank liquidity creation, while Section 3.4 synthesises evidence of how such impact can be altered by banks of different size classes. This chapter ends with a review of studies related to the influence of stock market liquidity on bank liquidity creation.

3.2 Theories of bank liquidity creation

The role of commercial banks as liquidity creators has long been recognised by economists and can date back at least to Smith (1776). The standard view of bank liquidity creation is that banks provide liquidity in the form of credit for agents that need additional liquidity in financing illiquid investment projects and, at the same time, allow deposit withdrawals at par value by agents who wish to invest their excess liquidity, but face random future consumption shocks (Berger & Bouwman, 2009; Deep & Schaefer, 2004; Longworth, 2007; Niehans & Hewson, 1976). In other words, bank liquidity creation enhances the access of the non-bank sectors to money – the economy's medium of exchange, as the bank holds illiquid non-monetary assets on behalf of the non-bank sectors, while allowing contemporaneous deposit withdrawals and access to credit for illiquid production projects. Hence, a liquidity mismatch between the left and right hand sides of bank balance sheet items is essential for liquidity creation to take place. For simplicity reason, maturity of bank assets and liabilities has been used to represent liquidity as contractual maturity is binding for most loans and deposits in the absence of any unexpected events. However, it should also be emphasized that, in practice, the concept of liquidity is much more complex than the concept of maturity can rationalise, because some bank balance sheet items are marketable and can be readily liquidated before they mature. For example, residential mortgages can be securitised and sold on the secondary mortgage market. In addition, during financial distress periods,

maturity does not accurately represent the liquidity stress of banks and the banking system as banks are prone to catastrophic fire sale of bank assets and bank runs.

Money creation is often treated as liquidity creation because the economy is more liquid when banks create more money through the issuance of loans which are assumedly illiquid. Without the assumption of illiquid bank loans, Niehans and Hewson (1976) show that money creation can be a misleading indicator of liquidity creation because money supply does not account for the liquidity of banks' assets[16]. In the theory of money supply, money aggregate, such as M1, M2 and M3, is calculated by summing currency in circulation and deposits of non-bank sectors (either including or excluding time deposits) (Niehans & Hewson, 1976; Mankiw, 2014). When a bank issues a new loan, it simultaneously creates a matching secondary deposit in the borrower's bank account from which the borrower transfers to his or her creditor's bank (Mankiw, 2014; McLeay et al., 2014). The bank gains the new deposits it has created if the creditor's account is with the bank, but loses the new deposits to its competing banks if the creditor's account is with a different bank. Repeatedly, the second bank creates money when it lends out[17]. As discussed previously, bank creates liquidity through a liquidity mismatch between bank assets and liabilities. If loans issued by a bank have the exactly matched liquidity as bank deposits, then the bank does not create any liquidity for the economy, despite the fact that money is created based on the money supply calculation. Likewise, if bank loans are more liquid than bank deposits, then bank liquidity creation is destroyed (Niehans & Hewson, 1976). Thus, care should be taken when treating money creation as equivalent to liquidity creation by banks because money creation disregards the liquidity of banks' asset claims.

The role of banks as a liquidity creator in the economy exists predominantly to cater for the needs of two agent-types, which are agents who are uncertain about their future cash flows needs for consumption and agents who have production opportunities with returns increasing on the investment horizon (Diamond & Dybvig, 1983; Diamond & Rajan, 2001; Dutta & Kapur, 1993; Fulghieri & Rovelli, 1998). It has been agreed that Bryant (1980) and Diamond and Dybvig (1983) were the first to systematically examine the liquidity creator role of banking intermediaries (Berger & Bouwman, 2009; Deep & Schaefer, 2004; Fulghieri & Rovelli, 1998; Hackethal et al., 2010). In these models, the emphasis

[16] Niehans and Hewson (1976) treat money creation as gross liquidity creation and liquidity creation as net liquidity creation.

[17] At the national aggregate level, money supply will increase several times at the end of the money creation process due to the money or deposit multiplier effect (Niehans & Hewson, 1976; Mankiw, 2014).

is on the role of demand deposits on the bank's liability side in facilitating risk sharing among individuals who consume at different random times. To smooth the consumption of these individuals, they must be granted the power to access their funds immediately and this can generally be attained through demand deposits - an essential component of liquidity creation. Both studies assume that illiquidity of assets is part of banks' lending technology and that banks collect deposits from individuals and invest in capital on their behalf. The existence of capital markets is not characterized in their models because direct investment in illiquid productive assets via capital markets directly exposes individuals to informational asymmetry about the risky assets and provides no better liquidity insurance against idiosyncratic (random) consumption shocks than banks' demand deposits. Besides, even if the asset claims can be traded in competitive markets with zero transaction costs, early liquidation of illiquid productive projects in the case of unexpected consumption shocks can produce low returns for investors. Since individuals are uncertain about their future consumption timing, they prefer investment in demand deposits, because banks have greater skills and expertise to transform illiquid assets into liquid claims, with a smoother pattern of returns depending upon the deposit period.

By pooling the liquidity of depositors and cross-subsidizing them, banks can offer efficient and optimal risk-sharing among depositors at an equilibrium where depositors' confidence in the banks is maintained. However, a large proportion of demand deposits underlying the bank's capital structure inevitably exposes the banks to a high risk of bank runs. A bank run is an undesirable equilibrium where all depositors panic and withdraw their deposits immediately, including those who are not concerned about the bank failing, before banks exhaust all of their assets due to the sequential service constraint. Bryant (1980) and Diamond and Dybvig (1983) also consolidated their models by demonstrating that demand deposits backed by reserves, government deposit insurance and suspension of convertibility are beneficial and work similarly to a central bank serving as lender of last resort in stopping or preventing bank runs. While their models do not suggest a true synergy between lending and deposits explicitly, they begin to establish the link between illiquid assets and liquid liabilities of the banks which is an essential element of liquidity creation.

The Diamond and Dybvig (1983) model has been followed by a number of investigations, extending or testing the model, including studies showing that banks lose their comparative advantages in providing risk sharing opportunities to a capital market that is unrestricted and liquid. These studies include Haubrich and King (1990), Jacklin (1987), von Thadden (1998) and Wallace (1988), which will be

discussed in Section 3.5. Particular famous contemporary bank liquidity creation theories are studies by Calomiris and Kahn (1991), Diamond and Rajan (2001), Holmstrom and Tirole (1998) and Kashyap et al. (2002).

While demand deposits are essential for liquidity creation, Calomiris and Kahn (1991) and Diamond and Rajan (2001) have demonstrated that demand deposits also serve as an incentive scheme for disciplining banks to act in the interests of uninformed depositors. Both studies place great importance on the sequential service constraint to compensate those depositors who are willing to invest in information and monitor banks, and assume incomplete deposit insurance because otherwise depositors will have no incentive to monitor the banks. On the asset side, loans made to entrepreneurs are illiquid because production investment is completely irreversible and it is difficult to realise its long-term value quickly. This makes it difficult for banks to extract the full loan value when the banks sell or borrow against the loans in the case that the banks require additional funds before the loans mature, since the banks cannot commit their specific collection skills to extracting full repayment from borrowers on behalf of new claim holders. Demand deposits on the liabilities side, however, satisfy banks' liquidity needs by allowing banks to borrow up to the full loan value if the banks can commit to depositors that the banks will deploy their specific collection skills in the future. The fragile capital structure disciplines the banks from withholding their collection skills against depositors' interests because such action will invite a run by depositors. Fearing this outcome, banks will commit and create liquidity in the process. Calomiris and Kahn (1991) and Diamond and Rajan (2001) also show that stabilisation policies, such as capital requirements, narrow banking and suspension of convertibility, are costly because each may reduce banks' commitments and liquidity creation and should thus be avoided.

Beyond banks' balance sheets, Holmstrom and Tirole (1998) have demonstrated that an efficient liquidity allocation for the private sector can be achieved through provisions of credit lines or loan commitment by banks. Their model considers three time periods. At time $t = 0$, a firm puts initial capital investment in a productive project that pays off at time $t = 2$. However, the firm faces a liquidity shock at time t = 1 when an additional capital investment is needed to continue the project or the project will be terminated in waste. They show that, unless there is an aggregate liquidity uncertainty in the private sector at time $t = 1$, whereby government supply of liquidity is needed, the private sector can achieve self-sufficiency by cross-subsidising liquidity-constrained firms. Issuing new claims on productive assets when liquidity shock hits and investing in liquid market securities at time $t = 0$ and selling them when

liquidity shock hits are possible solutions for liquidity-constraint firms. However, such actions are not efficient because the former may not be a timely solution and the latter can result in a wasteful accumulation of liquidity in the "lucky firm" that faces minimal liquidity shock. A line of bank credit, in contrast, offers the socially optimal liquidity allocation because banks pool and redistribute liquidity from lucky firms that do not encounter future liquidity shock to unlucky firms that need extra funds.

Similarly to demand deposits, loan commitments allow bank customers to obtain cash from the bank on demand to accommodate unexpected liquidity needs. Fulfillment of deposit-taking and commitment-based lending functions separately by two financial institutions requires maintenance of a large volume of liquid-asset stock such as cash and market securities on their balance sheet, which incurs a burdensome overhead cost for each institution. For example, the financial institution will forgo interest income if it keeps huge cash reserves, or face double taxation imposed on the returns on market securities. Kashyap et al. (2002) suggested that, by carrying out both deposit-taking and commitment-based lending functions within the same institution, the banking institution can attain significant synergy and get by with a smaller liquid buffer stock because both functions jointly share some of the costly overhead costs associated with the liquid-asset reserves if deposit withdrawals and commitment takedowns are less than perfectly positively correlated. In a normal economy state in which only a small fraction of deposits are withdrawn at any time, idle liquid-asset stock can be efficiently used to accommodate calls for committed lending by incumbent borrowers and insure them against liquidity shocks. Disproportionate growth of any part of the economy can otherwise result in financial instability and bank runs. Confirming the theory, Kashyap et al. (2002) also documented two key empirical observations. First, banks issuing greater amounts of demand deposits are more active in commitment-based lending. Second, banks offer more commitment-based lending as compared to non-bank intermediaries such as finance companies because banks offer deposit accounts.

To summarise, bank liquidity creation theories argue that banks create liquidity by financing illiquid assets with liquid liabilities on their balance sheet as well as through loan commitments and similar lines of credit beyond their balance sheet (Bryant, 1980; Diamond & Dybvig, 1983; Holmstrom & Tirole, 1998; Kashyap et al., 2002). Liquidity creation is important because banks hold illiquid non-monetary items for the non-bank public and give out liquid monetary items to satisfy their consumption and production needs, improving public welfare and economic growth. A liquidity mismatch between bank assets and liabilities inevitably makes banks susceptible to a fragile capital structure which, however, acts as an

incentive scheme for disciplining the banks to act for the interests of uninformed depositors (Calomiris & Kahn, 1991; Diamond & Rajan, 2001).

3.3 Influence of bank competition on bank liquidity creation

As a comprehensive measure of bank liquidity creation was not developed until the late 2000s, there have been limited empirical studies in the bank liquidity creation strand, and most of these studies do not focus on the effect of bank competition on liquidity creation. For example, Berger et al. (2010) examined the effects of regulatory interventions, capital injections and market discipline on bank liquidity creation; Berger and Bouwman (2009) and Lei and Song (2013) focused on the effect of bank capital, and Al-Khouri (2012) and Hackethal et al. (2010) focused on the effects of bank characteristics and macroeconomic factors. Some of these studies do include bank market concentration - usually represented by the bank's market share in terms of deposits, loans, total assets or the number of branches in the local market – to inversely proxy for bank competition. However, the effect of bank competition on liquidity creation remains ambiguous because bank market concentration is a misleading proxy for bank competition and has been widely criticised[18]. Our study has identified only four empirical studies focusing on the effect of bank competition on liquidity creation. To provide a thorough review of this topic, we also review previous studies that examine the impact of bank competition on bank credit availability because bank liquidity creation is partly attributed to bank credit which is mainly financed by bank liquid liabilities, such as demand deposits. Nevertheless, the empirical effect of bank competition on bank credit availability has been reported as mixed (Beck et al., 2004; Jeong & Joh, 2010; Love & Martinez Peria, 2013; Petersen & Rajan, 1995). Building on these prior studies, Horvath et al. (2013, 2016) suggest two opposing hypotheses regarding the effect of bank competition on bank liquidity creation, namely the "price channel" and "fragility channel" hypotheses. As such, our literature review in this section revolves around these two opposing hypotheses.

[18] Bank market concentration measures were widely used to inversely infer the degree of bank competition in earlier empirical work until the 1990s (Degryse & Ongena, 2008; Hainz et al., 2013). The relationship is underpinned by the structure-conduct-performance (SCP) hypothesis that argues that greater bank market concentration allows uncompetitive banks to extract monopoly rents. A main issue of bank market concentration measures is that they are confined to the definition of bank market structure and overlook banks' behaviours that drive their market power. Popular bank market concentration measures include the Herfindahl-Hirschman index (HHI) and the total market share of the largest n-banks. More details about issues of bank market concentration measures are in section 4.3.2.

3.3.1 Price channel hypothesis

The "price channel" hypothesis suggests a positive association between bank competition and liquidity creation. This hypothesis coincides with the standard industrial organisation theory that firms (banks in our case) with market power earn monopoly rent by providing products and services at below socially efficient levels (Chamberlin, 1969; Klein, 1971). This implies that borrowers are worse off from a lower equilibrium supply of credit at an inefficiently high price rate; and on the other hand, depositors are offered less return on their savings with banks. Thus, according to the theory, bank competition is desirable for liquidity creation because a bank that faces intense competition lowers its barriers to liquidity access for customers and reduces its intermediation margin by setting lower interest rates on loans and higher deposit rates than competing banks to attract more loan demand and deposits (Hannan, 1991; Guzman, 2000; Carbó-Valverde et al., 2009).

Guzman (2000) analysed how the equilibrium growth of an economy differs between an economy with a competitive banking market and an economy with a monopolistic banking market. The model assumes that all fund transfers between borrowers and lenders are intermediated by the banking system in the economy. Guzman shows that a competitive bank always offers a higher interest rate on deposits or/and a lower interest rate on loans than does a monopolistic bank. Similarly, credit rationing is less pronounced in a competitive banking system because, with the sufficiently high rate of return paid on deposits, a competitive banking system is able to draw all potential depositors into the system and obtain sufficient deposits for their asset investments. A monopolistic bank, on the other hand, views attracting deposits as too costly and thus, engages in credit rationing and profits from a huge net interest margin.

There are numerous empirical researches examining the impact of bank competition on interest rates on loans and supporting the "price channel" hypothesis indirectly. Hannan (1991) examined the relationship between commercial loan prices and bank market concentration across U.S. Metropolitan Statistical Areas (MSAs). He found a positive relationship between bank market concentration, measured by HHI of deposits, and commercial loan rates, specifically secured and unsecured fixed and floating rates, during the periods in which interest rates are stable and in trough. Such influence is not significant during interest rate peak because banks adjust the loan price upward more slowly in the concentrated market possibly due to the greater loan price rigidity in the market. Similarly, an increase in bank competition reduced secured and unsecured floating rates on small business loans in the U.S.

market (Hannan, 1997; Cyrnak & Hannan, 1999), the spread of bank loan rates over prime rates charged on Italian firms (Sapienza, 2002) and on small businesses in the U.S. (Berger et al., 2007). Using data from ten European countries from 1993 to 1999, Corvoisier and Gropp (2002) found an increase in interest margin earned by banks in concentrated markets, where the interest margin is calculated for each loan type, customer loans, short-term loans, long-term loans or mortgage loans, by deducting money market rates from the loan rates.

The influence of bank market power on deposit rates can be traced back at least to Berger and Hannan (1989) who found that bank market concentration significantly reduced interest rates on interest bearing demand deposits, saving deposits and time deposits based on 195 markets in the U.S. Heitfield and Prager (2004) reported a negative relation between bank market concentration and interest rates on saving and demand deposits at the local and state levels. Outside the U.S., Fischer and Pfeil (2004) have shown that increases in bank market power increase the interest margin earned by German banks, where bank market concentration is indicated by the HHI of bank branches, and the interest margin is defined as the difference between money market rates and deposit rates on savings of equal maturity. Corvoisier and Gropp (2002) found mixed implications of bank market concentration on banks' deposit pricing behaviours in ten European countries. On one hand, bank market concentration leads to less competitive pricing of demand deposit, as evidenced by significantly lower demand deposit rates. On the other hand, banks in concentrated markets compete intensely for saving and time deposits by offering higher rates. Their findings can be interpreted as banks with greater market power are likely to create less liquidity for the public as the less liquid deposit contracts are made less attractive for depositors.

In summary, bank market concentration is positively linked to a larger interest spread between deposit market and loan market (Degryse & Ongena, 2008). In line with the SCP theory that market concentration is an inverse indicator of the degree of market competition, previous findings imply that bank competition results in a decrease in loan rates and an increase in deposit rates, attracting more demand for bank loans and deposit taking by the bank. Based on a sample of bank loans from 70 countries, Hainz et al. (2013) reported that the lending procedure is made easier for borrowers in a competitive bank market, as evidenced by the reduced collateral requirement in the loan contracts. With lower barriers to bank credit access, borrowers are more incentivised to use bank credit, thus, more liquidity is created by the bank.

A number of empirical studies which have found that bank competition increases bank credit availability also offer some implications related to the "price channel" hypothesis. Beck et al. (2004) examined the impact of bank competition on firms' access to bank finance for 74 developed and developing countries. Their findings indicate that, on average, firms in a concentrated banking market face higher financing obstacles, implying a positive link between bank competition and firms' credit access. Such a positive relation is particularly strong in countries with low levels of economic and institutional development.

Using a survey dataset conducted on small business entrepreneurs in the U.S. in 2001, Scott and Dunkelberg (2010) found that entrepreneurs' perception of changes in bank competition over the past three years positively improved bank credit availability and non-credit banking outcomes, such as service quality. The use of entrepreneurs' ratings of changes in bank competition is superior over the use of bank concentration measures because this measure relies less on the definitions of market share of banks, which can be the number of bank branches, size of deposits and size of loans in the market.

Carbó-Valverde et al. (2009) studied the impact of bank competition on the financial constraints of Spanish SMEs over the period 1994 to 2002. Using the Lerner index to indicate bank market power, the study found that firms situated in less competitive banking markets were more dependent on trade credit than on bank credit because of credit rationing and a higher price for credit. Thus, Carbó-Valverde et al. (2009) concluded that the financial constraint is greater for firms when banks have greater market power. This finding is confirmed by Love and Martinez Peria (2013) who reported that bank competition is positively related to firms' access to bank finance, using cross-country data from 53 countries for the period 2002 to 2010.

The "price channel" hypothesis is also implied by the studies of Chong et al. (2013) and Shen et al. (2009) that examined the effect of bank competition on credit constraints of Chinese SMEs. Using SME survey dataset and bank branch information, Chong et al. (2013) found that bank competition reduces the credit constraints of Chinese SMEs by adjusting loan prices downward. The positive association between bank competition and SMEs' financing is not a result of relationship lending in which SMEs widely engage. The finding is robust for different measures of bank market concentration and credit constraints. A similar finding was reported by Shen et al. (2009) who measured bank competition by the

loan market share of the bank and SMEs' access to credit by the proportion of loans for SMEs over total enterprise loans granted by the bank at the end of the specific year.

Along similar lines, a positive effect of bank competition on bank credit availability can be observed indirectly through the growth of external financially dependent industries. For example, Claessens and Laeven (2005) examined the effect of bank competition on the growth of external financially dependent industries for 16 countries over the period 1980 to 1990. Using the Panzar and Rosse H-statistic to measure bank market competition, the result indicates that industrial growth is higher in countries with higher bank competition, implying that higher bank competition promotes more efficient allocation of bank resources for firms' investment projects through lower borrowing costs and greater credit availability.

Extending this line of reasoning, Cetorelli (2001, 2004) produced evidence that bank concentration increases the average firm size of industry sectors, especially those that rely heavily on external borrowings, in OECD countries. In other words, the market of the industry sector is more concentrated when the bank market is concentrated. Furthermore, the increased competition in the European Union (EU) bank markets arising from the EU bank deregulation leads to a decline in the average firm size of bank credit-dependent nonfinancial sectors (Cetorelli, 2004). Based on Cetorelli's findings (2001, 2004), banks with high market power are incentivised to preserve close lending relationships with their existing firm customers by concentrating funding on these customers at the expense of new entrants who possess a threat to the performance of the industry incumbents. The finding implies that bank competition promotes new entry of firms into the industry as more credit can be allocated to firms that are in need of liquidity.

3.3.2 Fragility channel hypothesis

The "price channel" hypothesis is quite limited because it ignores the specificity of banks and basically reduces banks to ordinary firms (Freixas & Rochet, 2007). The "fragility channel" view incorporates asymmetric information justifications of financial intermediation and argues that, in the presence of information asymmetries, a high degree of bank competition leads to a reduction in bank liquidity creation. A basic idea of this hypothesis is that banks that possess market power are likely to issue more credit, even to new, informationally-opaque or riskier borrowers because the market power enhances their ability to prevent their borrowers from switching to other banks and alleviates the adverse

selection problem of the banks (Petersen & Rajan, 1995; Dell'Ariccia & Marquez, 2004; Hauswald & Marquez, 2006). An increase in bank competition implies greater difficulty for banks to internalise the benefits of lending relationships, and subsequently eroding their incentive to create liquidity.

The "fragility channel" hypothesis is motivated by the theoretical model of Petersen and Rajan (1995) who predicted that banks in a concentrated market are more willing to establish lending relationships with young and information-opaque firms and subsidise the initial informational costs because the banks expect to share in the future surplus of the firms which survive[19]. In the presence of information asymmetries, a high degree of bank competition makes it more difficult for banks to internalise the benefits of lending relationships as the relationships break down easily. This happens because, once the firms are established, they will seek the cheapest credit available in the competitive banking market where other competing banks free-ride on the screening effort of the first lending bank and offer more attractive lending terms. The first bank loses its ability to hold up its borrowing firms and compensate for the information acquisition costs they bear at the early stage of the lending relationship. To avoid this free-riding problem, banks reduce investment in soft information acquisition through relationship lending, particularly with opaque customers, despite these customers being potentially of high quality, and reallocate credit toward incumbent captured borrowers with fewer alternatives (Petersen & Rajan, 1995). Credit availability to the economy falls as a consequence of an increase in competition among banks. The theoretical prediction of Petersen and Rajan (1995) can be extended to the liquidity creation role of banks, and be interpreted as banks possessing market power create more liquidity, as they are motivated to grant more loans through relationship-based banking, and in the meantime, accepting more deposits through the relationship. Dell'Ariccia and Marquez (2004) also obtained similar results, and suggested that banks that face greater competition from outside lenders reallocate credit toward borrowers that are locked-in – a situation referred to as a "flight to captivity".

Petersen and Rajan (1995) also proved their theoretical prediction by examining the impact of bank market competition on credit availability for small and fairly young firms operating throughout the U.S. in 1987. They focused only on small and young firms because the problem of asymmetric information related to creditworthiness of these firms is more acute for banks. They measured local bank market

[19] Petersen and Rajan (1995) contribute to a line of literature that focuses on the effect of bank competition on the credit access of small, information-opaque borrowers, a topic outside the scope of our study. However, Petersen and Rajan's (1995) findings have been widely applied with reference to the negative impact of bank competition on bank lending or credit availability to firms.

concentration by HHI of commercial bank deposits, and bank credit access by the percentage of trade credit discount taken by the firm[20]. Their empirical findings show that, irrespective of informational opacity measured by the firm's age, on average, firms in a concentrated banking market enjoy more bank credit access than firms of equivalent creditworthiness and credit demand in a competitive banking market. Such a finding is slightly inconsistent with their theoretical prediction that informationally-opaque firms enjoy greater access to credit in a concentrated banking market than in a competitive banking market. Of course, the inconsistency of the empirical findings can be questioned from the aspect of the variable measurement, such as the definition of bank credit access.

Consistent with the "fragility channel" hypothesis, Carletti and Leonello (2011) theoretically showed that banks behave more prudently in a competitive banking market. In this market, banks have incentive to invest more in liquid reserves and less in loans because loans are not very profitable for banks and the opportunity costs of holding reserves are low. Sufficient liquid reserves also have a benefit in shielding the banks from loan losses and bank runs during economic downturns. In contrast, a low competitive banking market makes liquid reserve holding more expensive, encouraging some banks to maintain below their optimal reserves and engage in illiquid asset investment.

Our study has identified only four empirical studies that explicitly investigated the relationship between bank competition and liquidity creation. These studies conducted by Horvath et al. (2013, 2016), Jiang et al. (2016), Joh and Kim (2012) and Xu (2010) support the "fragility channel" hypothesis for banks in the Czech Republic, the U.S., 25 OECD countries and 26 European countries, respectively. They argue that banks that face greater bank competition are more conservative in issuing loans and taking deposits, resulting in a drop in liquidity creation for the economy. These studies adopted the Berger and Bouwman liquidity creation measure to measure liquidity creation by individual banks and the Lerner Index to measure bank competition, except for Jiang et al. (2016) who applied deregulation-induced competition and Xu (2010) who employed the market share of individual banks in terms of liquidity creation amount to indicate bank competition.

In addition, some empirical liquidity creation studies that do not focus on bank competition, but do control for bank market competition in their estimations also report results consistent with the "fragility

[20] The intuition behind the use of the percentage of trade credit discount taken by the firm to proxy for bank credit access is that the firm is likely to borrow from trade creditors at the rates implicit in forgoing the early payment discount when having been credit-rationed by banks (Petersen & Rajan, 1995).

channel" hypothesis. For example, employing annual bank data of China between 1988 and 2009, Lei and Song (2013) found that liquidity creation by Chinese commercial banks increases when bank market competition falls, featured by a rise in HHI of bank deposits. Berger et al. (2010) reported that higher HHI of bank loans led to an increase in liquidity creation by German universal banks over the 1999 to 2008 period. Despite this, we are not able to derive a conclusive result based on these prior studies mainly because market concentration measures are weak proxies for bank competition in a liberalised banking era.

Besides, a number of empirical studies investigating the effect of bank competition on bank lending or firms' credit access have implied the "fragility channel" view. Fischer (2000) provided evidence on the influence of bank market power on bank's information acquisition activity and credit access by German manufacturing firms. Using HHI and other bank market concentration measures to proxy for bank market power, their study reveals two key findings. First, concentrated banking markets require firms to transmit not only more firm- and project-specific information but also more soft information that is in qualitative form. Second, credit availability, indicated by the frequency of early payment trade credit discounts taken by the firms, is greater in concentrated banking markets because of systematic information acquisition by the lending banks in the normal course of a lending relationship. Bank competition has an inverse relationship with firms' credit access because banks with low market power are less willing to subsidise loans for informationally-opaque firms that are costly to screen and monitor for fear of information spill-over, the free riding problem and switching behaviour of borrowing firms, as these firms may be taken over by competing banks as they grow. These findings are in consistent with Petersen and Rajan's (1995) theoretical prediction.

The "fragility channel" view is also implied by Zarutskie (2006) who investigated the impact on firm borrowing and investment of bank market competition resulting from the passage of the Riegle-Neal Act 1994, using a panel of U.S. privately held firms from 1987 to 1998. The years 1994 to 1998 are defined as a period of increased bank market competition following the Riegle-Neal Act. The study found that, under a competitive banking environment, young firms are financed less by bank loans and more by inside debt and equity because they are more informationally-opaque for banks. As the external debt and equity raised by young firms are very limited, these firms are accompanied by lower investment. Such a negative relation between bank competition and firms' borrowing diminishes as the firms become older.

Using aggregate banking market data from Korea, Jeong and Joh (2010) showed that bank lending is positively related to market concentration because banks are more aggressive in lending when they face less competition. The study employed the HHI as well as the total market shares of the top four largest banks to measure bank market concentration.

Cetorelli and Gambera (2001) adopted a different empirical approach to demonstrate that the growth of external financially dependent industries is faster in countries that have an uncompetitive banking market, based on industrial data from 41 countries between 1980 and 1990. The study reports that bank market concentration facilitates credit access by industries that require bank financing most, implying that bank market concentration encourages the establishment of lending relationships with firms that struggle for external borrowing. The finding is reinforced by Patti and Dell'Ariccia (2004) who presented evidence that bank competition hinders new firm entrants in Italian non-financial industrial sectors where informational asymmetries are greater as a consequence of limited credit availability to these firms.

Suffice to say, the existing relevant empirical literature yields very ambiguous evidence on the effect of bank competition on liquidity creation. Often, prior studies use structural competition measures to inversely proxy for bank competition, which could produce misleading results. Some may use the non-structural competition measure, but test limited components of bank liquidity creation, for example, bank lending. Thus, more empirical studies that directly address the relationship of interest are needed.

3.4 Bank size effect on the influence of bank competition on bank liquidity creation

It is likely that the effects of the “fragility channel” and the “price channel” coexist in the Malaysian banking sector, as the effect of bank competition on liquidity creation may not be uniform for commercial banks of varying sizes. For example, the kinds of information used in lending decision making, borrowers served and loan portfolios adopted by big and small banks are different (Berger et al., 2001, 2005b; Brickley et al., 2003; Cole et al., 2004; Stein, 2002; Strahan, 2008). In addition, size offers the possibility of realising economies of scale and scope for offering a diversified range of product lines for various market segments ranging from households, retail to corporate through extensive

branch networks (Vives, 2001). These operational differences between large and small banks can potentially alter the empirical relationship between bank competition and liquidity creation by these banks. Given that prior empirical studies have found that determinants of liquidity creation differ by bank size class, one of the main objectives of our study is to discover whether small and big banks also respond differently in liquidity creation when facing an increase in competition.

Stein (2002) provided a great insight into systematic differences in the information production and capital allocation between banks with a decentralisation structure - small, single manager banks, and banks with a hierarchy structure – big banks with multiple layers of management. Stein's model demonstrates that the advantage of decentralisation in a small bank entitles the loan officer to authorise capital allocation to loan applicants as he or she deems fit. This strengthens the loan officer's incentive to devote efforts to evaluate loan applications of informationally-opaque firms (characterised by small business firms) by researching their soft information. Soft information acquisition is in fact very costly as huge personnel costs and efforts are required. It requires the loan officer's personal communication over time with the firm, its stakeholders and the local community to gather information about the firm owner's character integrity and the local reputation of the firm's reliability. Unlike hard information, soft information cannot be easily and credibly quantified and verified by anyone other than the agent who produces it. In contrast, owing to more intermediaries between top management and loan officers at large banks, soft information generated by loan officers cannot be credibly communicated across successive hierarchical layers within the banks and their recommended loans can be easily vetoed by the upper management of the banks. As loan officers in large banks have to bear the risk of their research effort into small business firms, their incentives to produce high quality soft information of small, opaque firms for the benefits of the bank and its shareholders are slashed. It is diseconomies of scale for large banks to support both large and small business lending functions that require different kinds of information. Thus, Stein (2002) argues that large banks favour lending technologies based on hard information that can be used across branches and personnel in a standardised manner that can mitigate the agency problem, while small banks have a comparative advantage over large banks in lending technologies based on soft information.

Brickley et al. (2003) assert that small banks have an edge in the production of soft information, but the incentive for this activity is different from Stein's finding (2002). While Stein emphasises the incentive effects of the capital-allocation authority of loan officers, Brickley et al. (2003) suggest that substantial

and concentrated share ownership of small bank managers in the bank rewards the bank managers with significant decision-making authority and assists in mitigating agency problem. Based on 1998 data from the Texas banking industry, the share ownership held by bank officers and directors of small banks is 42 percent higher than that of big banks. The ownership concentration of big banks is also significantly lower than small banks, where most of the block shareholders in the small banks are officers and directors. Brickley et al.'s results support the notion that the decision authority granted to small bank managers provides an incentive for the managers to act in line with the bank shareholders' objectives, which also explains why small banks undertake more investment in soft information acquisition than do big banks.

This study borrows some relevant small business lending studies to highlight the comparative advantage of large banks in hard lending technology and small banks in using soft lending technology. These studies employ data of small business firms because small firms are generally informationally-opaque and some are potentially fundamentally sound, for which the type of small business lending technology employed differs by bank size[21].

Berger et al. (2005b) see both the findings reported by Stein (2002) and Brickley et al. (2003) as complementary and provided empirical evidence to support those findings using data from the 1993 U.S. National Survey of Small Business Finance (NSSBF). The authors identified six key findings: (i) smaller banks have a comparative advantage in lending to smaller firms whose hard information, such as financial records, are not readily available; (ii) smaller banks lend at a shorter physical distance from their borrowing firms to facilitate soft information collection; (iii) smaller banks are more likely to have personal or face-to-face communication with their customers in contrast to large banks that rely on mundane technologies such as mail and telephone; (iv) small banks maintain longer relationships and (v) make exclusive relationships with their borrowing firms by being the firms' only lender; (vi) small banks practise less credit rationing to their borrowing firms, as evidenced by firms' lower reliance on

[21] Small business lending technologies use some combination of both hard and soft information, and in many cases, multiple lending technologies are employed for lending to the same firm (Berger, 2014; Berger & Black, 2011; Berger & Udell, 2006). Among these, lending technologies primarily based on hard information are fixed-asset lending, asset-based lending, financial statement lending and credit-scoring. On the contrary, lending technologies that are primarily based on soft information include relationship lending and judgment lending (see Berger, 2014 for details).

expensive trade credit. These findings support the notion that small banks specialise in relationship-lending.

Using the same dataset as Berger et al. (2005b), Cole et al. (2004) reported that credit extension by large banks is higher for small business firms that can provide financial records, but such lending decision is uninfluenced by any firm-bank relationship factors. On the other hand, firms that have prior deposit relationships with small banks are more likely to have loan applications approved by the banks. Their financial records do not play any significant role in the lending decisions of small banks. These findings imply that large banks favour lending technologies based on hard information, while small banks favour relationship-lending. Outside the U.S., Berger et al. (2001) found evidence consistent with large banks' diseconomies of scale in relationship lending in Argentina. Large banks face greater obstacles in extending relationship loans to small and informationally opaque firms.

Besides, some studies report that small banks devote more of their lending resources to small business lending than larger banks[22] (Berger & Udell, 1995; DeYoung et al., 2004; Strahan & Weston, 1998). As a bank becomes larger and more complex in its organisational structure and offerings of financial products and services, the share of credit supplied to small business firms falls in relation to total assets (Berger & Udell, 1995; Strahan & Weston, 1998) and within the loan portfolio (DeYoung et al., 2004). Moreover, Strahan and Weston (1998) provide evidence that an increase in the average size of subsidiaries, that is diversification of small banks leads to a greater share of small business lending in the asset portfolio, while diversification of large banks is associated with a greater share of large business lending in the asset portfolio.

Both the organisational form and traditional small business lending research strands have collectively reported that external financing to small or opaque firms can only be provided by soft lending technologies in which small banks have the competitive advantage. Large banks, on the other hand, specialise in hard lending technologies for large and transparent firms. This argument, however, may no longer be fully supported in recent banking environments because financial sector development,

[22] A limitation of the studies of Berger and Udell (1995), DeYoung et al. (2004) and Strahan and Weston (1998) is that their studies do not not explicitly control for opacity and relationship-related factors of borrowing firms. A larger share of small business loans in small banks' asset and loan portfolios is arguably to support the comparative advantage of small banks in soft information processing and relationship-lending; however, such portfolios can also be explained by small banks' policy of maintaining a well-diversified loan portfolio (Strahan, 2008). For a small bank, a large business loan will crowd out some small business loans and reduce its loan diversification.

particularly due to advances in technology, may have altered the way banks traditionally lend and the inter-bank competition they face.

Previous studies have documented that, owing to high fixed and sunk entry costs, large banks adopt new technologies earlier than small banks and enjoy economies of scale in the technology adoption (Akhavein et al., 2005; Berger et al., 2005a; Frame et al., 2001; Furst et al., 2002; Petersen & Rajan, 2002). Akhavein et al. (2005) found that large banks adopt small business credit scoring technology earlier than small banks. Large banks that adopt small business credit scoring tend to increase loan issuance to small business firms because credit scoring improves the ability of banks to price the risk by charging higher loan premiums on small business loans (Berger et al., 2005a; Frame et al., 2001). Thus, information and underwriting costs traditionally faced by large banks in small business lending lessen (Frame et al., 2001). Credit scoring also allows banks to issue riskier small business loans and reduce credit rationing on these firms as the problem of under-pricing of risky loans is diminished. In addition, large banks are more likely to adopt Internet banking relative to small banks and gain from a significant improvement in profitability and efficiency (Furst et al., 2002). The benefits of Internet banking, however, do not exist in small banks.

Some small business lending studies have gone beyond the traditional research paradigm and found results contradictory to the the traditional paradigm. Petersen and Rajan (2002) argued that advances in technology have improved the diseconomies scale of large banks in small business lending as new technologies cut down the cost of expensive information acquisition about small firms, reducing the importance of soft information in small business lending in which small banks traditionally have an edge. Petersen and Rajan concluded that the physical distance as well as the personal communication between small firms and their lenders has become less important over time in the U.S. Also rejecting the traditional paradigm that concludes that large banks are ill-equipped lenders to small firms, Berger et al. (2007) reported that large banks have neither competitive advantage nor disadvantage in providing loans to informationally-opaque small businesses. They explain that large banks deploy some forms of transactions lending technologies that analyse the creditworthiness of business firms based primarily on data about the small business owner rather than business data.

Berger and Black (2011) analysed the comparative advantages of large and small banks in using different lending technologies for U.S. small business firms of varying sizes. A key finding shows that large banks

have comparative advantages of using hard lending technologies when lending to large and small firms. Berger and Black (2011) argued that large banks take the advantage of some lending technologies based on hard information, such as valuations of fixed-assets that are pledged as collateral, in lending to small firms. Besides, small banks indeed have a comparative advantage in relationship lending, but this advantage is strongest for larger firms. The findings of Berger and Black (2011) help to explain why some studies, like those of Jayaratne and Wolken (1999), did not find any significant effect of the existence of small banks on the credit availability of small firms operating in the U.S. A possible explanation is that large banks are better at employing some forms of hard technologies to lend to small, opaque firms.

Nevertheless, both traditional and new paradigms in small business lending research agree that that large banks favour using hard information in lending, while small banks have an advantage in lending technologies based on soft information, such as relationship lending, for opaque firms. We, thus, expect that liquidity creation by small banks is more affected by bank competition in the way specified by the "fragility channel" hypothesis. Small banks must possess market power to some degree to be incentivised to invest in opaque or risky customers by providing soft lending, because market power allows the banks to lock in the customers and share in their surplus. An increase in competition will spur customers' switching problem and prevent the banks recovering from costly information production and monitoring from investing in opaque or risky customers, thereby dissuading banks from creating liquidity. In contrast, the role that competition plays in the liquidity creation of large banks is uncertain. While diseconomies of scale and the agency problem discourage large banks from using soft information, large banks are not at a disadvantage in lending to informationally opaque customers. This is because there are various transaction lending technologies that large banks may deploy in small business lending, which include asset-based lending, leasing and small business credit scoring (Berger et al., 2007). Combining the economies of scale in extensive branch networks and early technology adoption, large banks may have greater capacity that enables them to expand their liquidity creation activities in new and existing market segments when facing an increase in competition.

Previous bank liquidity creation studies that control bank market competition in their models may also provide implications for the bank competition-liquidity creation relationship by bank size classes. In Berger and Bouwman's (2009) study for the U.S., liquidity creation by small banks is positively associated with their market power, measured by bank-level HHI on deposits, implying the "fragility channel" dominates over small banks. They did not find significant links between bank market power and liquidity

creation for medium-sized and large banks. Besides, Berger et al. (2010) found that an increase in bank market concentration, indicated by loan concentration index, leads to higher liquidity creation by small banks, but there was no significant effect found for large banks in Germany. Xu (2010) reported that bank market power, measured by market share of liquidity creation at bank-level, increases the liquidity creation of large banks in both European countries and Switzerland and small banks only in the developed European countries. Furthermore, a robustness test in Joh and Kim's (2012) cross-country study for 25 OECD countries showed that large banks increase liquidity creation as the banking industry becomes more concentrated. Bank market concentration, however, is not significantly linked to liquidity creation in the case of small banks. We regard these previous evidences as weak and inconclusive because the use of structural measures of bank competition in these studies has been criticised by new industrial organisation advocators for not reflecting banks' behaviour that drives their market power.

It is apparent that banks of varying size classes conduct their business very differently, but how the operational differences alter the effect of bank competition on liquidity creation is vague. Thus, our study attempts to address this issue by examining the relationship between bank competition and liquidity creation of commercial banks by bank size.

3.5 Influence of stock market liquidity on bank liquidity creation

Generally, stock market liquidity is defined as the extent to which market participants can quickly and easily trade large volumes of their equity securities without causing much fluctuation in the security prices (Borio, 2000; Committee on the Global Financial System, 1999; Sarr & Lybek, 2002). This notion of liquidity also embodies the cost of converting a stock into money, or in other words, the transaction cost for stock investors (ECB, 2012). To establish a liquid stock market, substitutability among the various securities traded in the market as well as the liquidity of each of these assets play an important role (Sarr & Lybek, 2002).

A liquid stock market generally exhibits five characteristics: (i) tightness, (ii) depth, (iii) breadth, (iv) resiliency and (v) immediacy (Borio, 2000; Committee on the Global Financial System, 1999; Kyle, 1985; Sarr & Lybek, 2002). Tightness refers to the costs of turning around a position in a short period of time, usually captured by the difference between buy and sell prices, and the implicit costs. Depth denotes the existence of abundant orders at the prevailing market prices, while breadth refers to numerous and large volumes of orders with minimal impact on prices. Resiliency represents the speed with which new

orders flow corrects order imbalances that result in an idiosyncratic shock to security prices. Immediacy refers to the speed with which orders can be executed and settled, or in other words, the efficiency of the trading, clearing and settlement systems (Sarr & Lybek, 2002). These characteristics are to some extent overlapping, and incorporated in the general definition of market liquidity. For example, a deep, broad and efficient stock market is usually accompanied by low transaction costs (tightness).

The theories of bank liquidity creation highlighted in Section 3.1 show that demand deposit is an important source of funds for banks to carry their liquidity creation role under a key assumption that investors (savers) engage only in intermediated investments through banks and firms seek external funds only from banks. However, as the financial system evolves and gets more liberalised, the incentive problems related to the investment choices of depositors, corporate financing choices as well as banks' supply of liquidity, have changed. These issues have been considered in some studies which are reviewed here to demonstrate how a liquid stock market can potentially crowd out or enhance banking arrangements through both supply and demand sides of bank liquidity creation.

3.5.1 Market-bank liquidity crowding out hypothesis

Jacklin (1987) was the first to extend the Diamond-Dybvig model by studying the risk sharing mechanism of demand deposits in relation to equity shares. The study shows that demand deposits better facilitate risk sharing among depositors with different consumption patterns than equity shares only when there are trading restrictions imposed on the deposits. Such advantage, however, is lost when the market becomes frictionless with greater trading opportunities. In this case, equity shares provide identical risk sharing opportunities as demand deposits. Investors then have an incentive to invest directly in illiquid assets and not via banks, because the investors can reap the higher, long-term returns on their investments if they do not encounter liquidity shocks, and they can trade their shares for liquid assets – cash – quickly when they are stricken by liquidity shocks. While the focus of Jacklin's (1987) study is risk sharing of demand deposits, the findings reveal that a liquid equity market has the ability to compete with commercial banks for demand deposits and constrain their cross-subsidising ability for savers who have different patterns of liquidity need, hence, reducing the amount of liquidity created by banks.

In addition, Wallace (1988) finds that investors are better off with direct investments regardless of their random consumption patterns if they are not isolated - an environment that resembles the capital market today where investors are brought together by technology over the counter or centralised

exchange. Without isolation, investors would want to invest in assets directly, and when they need to withdraw money before the investment matures, they borrow short-term from other investors in a credit market by pledging their share in real investment as collateral. This result implies that a capital market should be viewed as a substitute trading mechanism for banks' deposit arrangements if the market is easily accessed by investors. Similar findings about the diminishing liquidity creation role of banks as a consequence of increasing capital market liquidity are also documented by Haubrich and King (1990) and von Thadden (1998). Both studies argue that the presence of banks is not rationalised in an economy where the capital market is completely liquid to offer insurance to investors against liquidity risk.

Extending beyond the competition with banks in providing insurance against idiosyncratic shocks for investors, Levine (1991) and Bencivenga et al. (1995) have demonstrated that a liquid stock market accompanied by low transaction costs alleviates liquidity risks of investors and incentivises firms to finance their long-term productive investment projects directly from investors on the market. Like other theoretical papers, Levine (1991) and Bencivenga et al. (1995) characterised that investors are discouraged from investing in the illiquid firm capital owing to the fear of premature liquidation of productive investments in the case of liquidity shock and the resulting low liquidation returns. They argue that a liquid stock market alleviates the long-term capital commitment of investors by allowing them to change their portfolios quickly and cheaply with other investors who do not receive liquidity shock. The investors can also cash in their shares in the firms for a value greater than the premature liquidation value. Meanwhile, liquidity-constrained firms are insured from productivity risk as premature liquidation of productive assets can be avoided, encouraging longer-term firm investment and economic growth. Although Levine (1991) and Bencivenga et al. (1995) did not focus on the competitive pressure of liquid stock markets on commercial banks, their findings indicate that liquid stock markets reduce firms' reliance on banks for capital funding and encourage more savings to be channelled to stock markets.

Diamond (1997) has theoretically shown that the magnitude of liquidity creation by banks and the capital structure of banks are dependent on the liquidity of the capital market. In an economy with an imperfectly liquid financial market, banks create liquidity in two fundamental ways: (i) by holding some of the economy's assets for which funds cannot be raised in the market, and (ii) by cross-subsidizing investors (depositors) with higher short-term returns than the market. However, as more investors

participate in the financial markets, the improved market liquidity will attract a greater amount of funds being placed on financial asset investment in the markets, which would otherwise be saved in banks. Furthermore, highly liquid financial markets allow firms to issue longer-maturity securities for capital and narrow the maturity gap between the securities and the physical investments. The maturity gap approaches zero as the market approaches full liquidity. As such, Diamond (1997) concluded that a fully participated (or liquid) capital market does not only slash the scope of cross-subsidisation for depositors, but also causes the banks' holdings of long-term assets (term loans) to drop more rapidly than their holdings of shorter-term loans. The magnitude of liquidity created by banks and the whole banking system shrinks as a consequence.

While a large body of theoretical studies predicts a negative link between stock market liquidity and bank liquidity creation, it is surprising that not many empirical studies have been conducted and even fewer studies have supported the prediction. Dey and Flaherty (2005) examined the determinants of stock market liquidity and bank credit using a panel dataset of 32 exchanges from 27 countries over a period of 40-84 months during 1995-2001. They showed that bank credit and stock market liquidity, measured by stock market turnover ratio, are inversely related, indicating that a liquid stock market may be a substitute for banks from the aspect of firms' external financing sources. Firms may find raising capital on a liquid equity market substantially cheaper than bank loans because, after accounting for the lower investment banks' fees and liquidity risk to investors, the under-pricing problem of equity and the required return on equity drop (Acharya & Pedersen, 2005; Butler et al., 2005).

3.5.2 Market-bank liquidity enhancement hypothesis

Built upon the traditional theory discussed in Section 3.5.1, a standard view has been that an increase in stock market liquidity exerts a competitive pressure on commercial banks and increasingly replaces banks' liquidity creator role in the economy. The "market-bank liquidity crowding out" hypothesis may hold if one merely focuses on the traditional products offered by commercial banks, specifically demand deposits and commercial loans, and overlooks the changes in the microeconomics of banking along with the development of the liquid stock market, for instance, the dynamic pool of borrowers and depositors, the risk-bearing capacity of banks and their off-balance sheet innovations. Acknowledging these, some studies have suggested and documented an "enhancement effect" of stock market liquidity on bank liquidity creation.

A theoretical analysis by Song and Thakor (2010) has argued that, without introducing bank equity (an interaction vehicle) into the model, a liquid stock market indeed grows at the expense of banks – a finding that supports the "market-bank liquidity crowding out" hypothesis in the existing theoretical literature that views banks and capital markets in isolation. As financing cost is one of the key frictions impeding borrowers from raising funds, it becomes a key determinant of borrowers' financing choices between banks and capital markets. Increased stock market liquidity reduces the financing friction of firms on a stock market and attracts firms to opt for market over banks for financing sources. In contrast, when the bank equity element is introduced, an "enhancement effect" flowing from the stock markets to banks is observed, which implies that stock market liquidity enhances the magnitude of liquidity creation by publicly-listed banks. As stock market liquidity reduces the bank's cost of equity capital, the bank may find it optimal to raise additional equity capital from the liquid stock market to meet the higher capital requirements associated with greater lending scope to potentially creditworthy yet previously unserved borrowers. This means that additional loans can be originated by banks for a greater scope of borrowers if the banks are able to raise additional capital at attractive prices from the liquid stock market to maintain their solvency.

Like some theoretical studies, Mattana and Panetti (2014) characterised an economic growth model where banks and stock markets compete in offering depositors with insurance against idiosyncratic consumption shocks and profitable investment opportunities, but their analysis goes beyond the traditional issue and finds that greater stock market liquidity indeed encourages banks to engage in more illiquid asset investment. As previously assumed, there is a trade-off between liquidity insurance and return on illiquid capital, and depositors decide on either market or bank channel to invest their deposits based on the expected welfare that they can achieve within the two channels. To maintain banks' ability to offer the cross-subsidisation of impatient depositors, banks must retain a fraction of liquidity in their own portfolio before investing in illiquid assets. However, as the income level of depositors rises beyond the stock market participation threshold, stock market participation increases and banks reduce their investment in liquid reserves required to meet the consumption of impatient depositors and shift their asset portfolio towards illiquid assets. In other words, increased stock market liquidity diverts some demand for liquidity away from banks and creates an opportunity for banks to reduce their liquidity holdings on the balance sheet and to channel more liquidity towards capital investments.

Extending beyond the traditional products like demand and savings deposits and loans, the positive influence of stock market liquidity on bank liquidity creation can be observed through the bank's provision of off-balance sheet products, such as guarantees, commitments and similar contractual arrangements that the banks must provide liquidity to the customers upon demand. By offering off-balance sheet products, commercial banks attain optimal liquidity allocation because a unit of liquid reserve can be used to back the liquidity needs of multiple firms in a stable economic state, as opposed to direct bank lending for which one unit of liquid reserves serves only a single firm (Holmstrom & Tirole, 1998; Kashyap et al., 2002). While a liquid stock market motivates large firms to raise capital directly from investors, the firms also seek bank guarantees and commitments that serve as a primary backup source of corporate financing in case the firms fail to raise sufficient funds to their expected level (Rajan, 1998). In other words, despite competing with banks, liquid stock markets also stimulate greater use of off-balance sheet commitments, creating an opportunity for banks to create more liquidity and achieve efficient liquidity allocation.

Empirical studies that have examined the influence of stock market liquidity on bank liquidity creation explicitly are very limited. Using the quarterly U.S. commercial bank data from 1984 to 2010 and time-series regressions, Chatterjee (2015) found that stock market liquidity positively explains aggregate bank liquidity creation growth as well as liquidity creation growth of large banks. The author argued that, as stock market liquidity implies the cost of capital in the marketplace, increased stock market liquidity smoothes the financial constraints of banks, particularly those of large banks that employ relatively larger amounts of non-deposit funding to support their asset investments. Furthermore, Chatterjee (2015) found that stock market liquidity has a higher impact on off-balance sheet bank liquidity creation than on-balance sheet liquidity creation – a finding that supports the argument that liquid stock markets stimulate greater use of off balance sheet commitments. In Chatterjee's study, stock market liquidity is measured by proportional quoted bid-ask spread, Amihud's illiquidity ratio and Roll's implied spread[23].

Empirical studies that have examined the development of the stock market and the banking sector also provide useful insights for our study. Demirgüç-Kunt and Maksimovic (1996) have argued that corporate

[23] Our study also employs proportional quoted bid-ask spread and Amihud's illiquidity ratio to proxy for stock market liquidity. We do not use Roll's implied spread because the underlying assumptions of the measure, such as an informationally efficient stock market and stationary price change of stocks, are not satisfied in Malaysia's illiquid stock market.

finance choices vary with the development of the stock market[24]. In developed stock markets, further market development leads to a crowding out effect of equity financing on bank lending. In contrast, in developing stock markets, large firms' debt to equity ratio increases as the market develops, while the financing choices of small firms are unaffected by the market development. In developing stock markets, large firms' borrowing capacity tends to increase with their equity financing ability as they are increasingly "certified" by the market. Thus, for these firms, stock market development stimulates the demand for bank loans. Demirguc-Kunt and Levine (1996b) studied stock market and financial intermediary development for forty four developing and industrial countries. A key finding of the authors' study is that stock market liquidity, measured by stock market trading value to GDP and turnover ratio, is positively correlated with both bank credit to GDP and claims of deposits on banks to GDP, which implies a positive relationship between stock market liquidity and bank liquidity creation.

As none of the existing empirical studies has yielded strong and unambiguous findings on the effect of stock market liquidity on bank liquidity creation, we are not able to generalise previous findings to the Malaysian financial environment positively.

[24] In Demirgüç-Kunt and Maksimovic (1996), stock market development is measured by the average ratio of stock market capitalization to GDP, the ratio of total value of traded shares to GDP, the ratio of total value of traded shares to market capitalization and a pricing indicator.

Chapter 4

Data and Research Methodology

4.1 Introduction

This chapter comprises three sections and begins by describing the sample selection and data collection procedures in Section 4.2. Next, Section 4.3 details the methods this study employs to calculate bank liquidity creation, bank competition, stock market liquidity and other explanatory variables. Section 4.4 presents the regression model and describes the estimation procedure of the fixed-effects estimator used in this study.

4.2 Sample and data

The study sample covers almost all commercial banks operating in Malaysia during the 2001 to 2013 period. Our sample years begin from the year 2001 to avoid massive mergers, acquisitions and exits of commercial banks in the late 1990s due to repercussions of the 1997 Asian financial crisis, making our dataset more representative of today's bank market structure in Malaysia[25]. Besides, only banks that have data available for at least three consecutive years are included in our sample. During the sample period, three mergers and acquisitions of domestic commercial banks took place. In all cases, the banks were merged into one of the pre-merger bank counterparts[26]. Hence, we treat each pre-merger bank as a separate bank, with one bank continuing to operate after the merger. Further, eliminating outliers is an important task in bank competition measurement since outliers can have serious influences on the estimation of banks' marginal costs and the resulting banks' market power (Coelli et al., 2005). We, thus, eliminated the observations whose output and input prices are zero or more than ±2.5 times the standard deviation, following de Guevara and Maudos (2011). The sampling process results in an unbalanced panel of 27 commercial banks with a total of 294 observations, which account for over 96 percent of total industry assets during the sample period. Furthermore, this study categorises small banks as banks holding total assets of up to MYR20 billion and large banks as banks holding total assets

[25] The choice of the year 2001 can be supported by Abdul-Majid and Sufian (2006) who argue that the year 2001 marks the structural break in the Malaysian commercial banking industry due to the consolidation exercise announced in 1999.

[26] To specify, Bank Utama (Malaysia) Berhad was merged into RHB Bank Berhad in 2003, Southern Bank Berhad was absorbed into CIMB Bank Berhad in 2006 and EON Bank Berhad was merged into Hong Leong Bank Berhad in 2011.

exceeding MYR20 billion. A breakpoint of MYR20 billion is used because a substantial leap of about 27 percent in total assets between the banks before and after this value is observed, that is, from MYR 16 billion to MYR 21 billion. The full sample banks and their size classification are listed in Appendix A.

In addition, this study uses the data of Islamic banks to incorporate their behaviour in the measurement of competition facing commercial banks. A total of 18 fully fledged Islamic banks were in business during the sample period. After deleting bank observations with insufficient and outlier data, 16 Islamic banks with 103 observations were left for the measurement.

All the bank data used in this study were drawn from banks' annual reports and are checked against Bureau van Dijk's Bankscope database. The aggregate stock market data were obtained from Bursa Malaysia database, while individual stock data were obtained from DataStream database. Before applying data filters specific to individual stock market liquidity measures, preliminary criteria were imposed on stock data. This study restricted stock data to only common stocks listed on Bursa Malaysia Main and ACE markets (previously secondary board). Exchange-traded funds, warrants, closed-end fund, preferred stocks as well as suspended stocks were excluded. Stocks with missing stock data were also deleted. This left us with 1,265 stocks trading in the sample period. Further data filters were also applied specifically to individual stock market liquidity measure and are detailed in each stock market liquidity measurement section.

Macroeconomic data were obtained from the Department of Statistics Malaysia and the Central Bank of Malaysia databases. Country-level economic freedom and governance indicators of Malaysia were obtained from the Heritage Foundation and the World Bank databases. All financial values are expressed in real 2013 MYR using the GDP price deflator sourced from IMF.

4.3 Measurements of variables

This section discusses the variables used in the study and their measurements. The dependent variable is bank liquidity creation, and the explanatory variables of interest are bank competition and stock market liquidity. A wide range of control variables are also included in our regression models.

4.3.1 Measurement of bank liquidity creation

To measure bank liquidity creation at bank level, this study employs the three-step procedure developed by Berger and Bouwman (2009). The Berger and Bouwman framework allows researchers to construct their own liquidity creation measures using information on product category (*Cat*) or maturity (*Mat*) of bank balance sheet items or a mix of both "*Cat*" and "*Mat*" information, depending on the nature of the balance sheet data availability[27]. Four alternative liquidity creation measures were developed by Berger and Bouwman (2009) in their study, namely "*Cat fat*" and "*Mat fat*" for liquidity creation measures including both on- and off-balance sheet items and "*Cat nonfat*" and "*Mat nonfat*" for liquidity creation measures including on-balance sheet items and excluding off-balance sheet items.

Because our dataset does provide a maturity breakdown of two major bank liquidity creation activities – loans and deposits, we are able to construct "*Mat*" liquidity creation measures, in addition to "*Cat*" measures. Table 4.1 summarises the three-step procedure employed to construct our "*Cat*" and "*Mat*" liquidity creation measures.

[27] For example, Fungacova and Weill (2012), Fungácová et al. (2013b) and Hackethal et al. (2010) employed only "*Cat nonfat*" and "*Mat nonfat*" liquidity creation measures and excluded off-balance sheet items from their measurement due to data restriction. Horvath et al. (2013, 2014) classified all on- and off-balance sheet items purely based on "*Mat*", while Berger and Bouwman (2012) and Joh and Kim (2012)) classified all items based entirely on "*Cat*".

Table 4.1 Berger and Bouwman (2009) liquidity creation measure
Step one: Classify all bank activities as liquid, semi-liquid or illiquid based on product category (*Cat*) or maturity (*Mat*)
Step two: Assign weights to the activities classified in step one

Assets		
Illiquid (weight = $\frac{1}{2}$)	**Semi-liquid (weight = 0)**	**Liquid (weight = $-\frac{1}{2}$)**
Cat	***Cat***	***Cat* / *Mat***
Commercial, industrial and business loans	Consumer/retail loans	Cash and short-term funds
Other loans	Residential mortgage loans	Deposits and placements with banks and other financial institutions
Property, plant and equipment	Interbank loans	Securities
Investment in subsidiaries, joint ventures and associates	Loans to governments and statutory bodies	Derivative assets at fair value
Intangible assets		
Deferred taxation		
Other non-current assets		
Mat	***Mat***	
Loans, advances and financing with a remaining maturity of more than one year	Loans, advances and financing with a remaining maturity of less than one year	
Property, plant and equipment		
Investment in subsidiaries, joint ventures and associates		
Intangible assets		
Deferred taxation		
Other non-current assets		

Liabilities and equity		
Liquid (weight = $\frac{1}{2}$)	**Semi-liquid (weight = 0)**	**Illiquid (weight = $-\frac{1}{2}$)**
Cat	***Cat***	***Cat***
Transaction deposits	All term deposits	Subordinated debts
Saving deposits	Other deposits	Bonds and debentures
Money market deposits	Repos	Other non-current liabilities
Deposits from banks		Equity
Derivative liabilities at fair value		
Mat	***Mat***	***Mat***
Term deposits maturing within six months	Term deposits with a remaining maturity of between six months and one year	Term deposits with a remaining maturity of more than one year
Transaction deposits	Repos	Subordinated debts
Saving deposits		Bonds and debentures
Money market deposits		Other non-current liabilities
Deposits from banks		Equity
Derivative liabilities at fair value		

Off-balance sheet items		
Illiquid (weight = $\frac{1}{2}$)	**Semi-liquid (weight = 0)**	**Liquid (weight = $-\frac{1}{2}$)**
Cat / Mat	***Cat / Mat***	
Direct credit substitutes	Unconditionally cancellable credit commitments	
Standby letters of credit		
Unutilised credit card lines		
Forward purchase commitments		
Contingent liabilities		

Step three: Combine bank activities as classified in step one and weighted in step two to construct four alternative liquidity creation measures

CATFAT =	+ $\frac{1}{2}$ *illiquid assets (*Cat*)	+ 0*semiliquid assets (*Cat*)	$-\frac{1}{2}$ *liquid assets (*Cat*)
	+ $\frac{1}{2}$ *liquid liabilities (*Cat*)	+ 0*semiliquid liabilities (*Cat*)	$-\frac{1}{2}$ *illiquid liabilities and equity (*Cat*)
	+ $\frac{1}{2}$ *illiquid off-balance sheet items	+ 0*semiliquid off-balance sheet items	$-\frac{1}{2}$ *liquid off-balance sheet items
CATNONFAT =	+ $\frac{1}{2}$ *illiquid assets (*Cat*)	+ 0*semiliquid assets (*Cat*)	$-\frac{1}{2}$ *liquid assets (*Cat*)
	+ $\frac{1}{2}$ *liquid liabilities (*Cat*)	+ 0*semiliquid liabilities (*Cat*)	$-\frac{1}{2}$ *illiquid liabilities and equity (*Cat*)
MATFAT =	+ $\frac{1}{2}$ *illiquid assets (*Mat*)	+ 0*semiliquid assets (*Mat*)	$-\frac{1}{2}$ *liquid assets (*Mat*)
	+ $\frac{1}{2}$ *liquid liabilities (*Mat*)	+ 0*semiliquid liabilities (*Mat*)	$-\frac{1}{2}$ *illiquid liabilities and equity (*Mat*)
	+ $\frac{1}{2}$ *illiquid off-balance sheet items	+ 0*semiliquid off-balance sheet items	$-\frac{1}{2}$ *liquid off-balance sheet items
MATNONFAT =	+ $\frac{1}{2}$ *illiquid assets (*Mat*)	+ 0*semiliquid assets (*Mat*)	$-\frac{1}{2}$ *liquid assets (*Mat*)
	+ $\frac{1}{2}$ *liquid liabilities (*Mat*)	+ 0*semiliquid liabilities (*Mat*)	$-\frac{1}{2}$ *illiquid liabilities and equity (*Mat*)

4.3.1.1 Step one: classify all bank activities as liquid, semi-liquid or illiquid

All banks' balance sheet activities are classified as liquid, semi-liquid or illiquid based on the ease, cost and time rule. Specifically, all assets are classified as liquid, semi-liquid or illiquid based on the ease, cost and time for banks to dispose of their assets to obtain liquid funds upon customers' demands. Bank liabilities and equity are classified as liquid, semi-liquid or illiquid based on the ease, cost and time for customers and investors to obtain liquid funds from the bank. Off-balance sheet items are similarly treated using the ease, cost and time rule.

a. Assets

   For the "*Cat*" liquidity creation measures, commercial and industrial loans are categorised as illiquid assets because these loans cannot be liquidated quickly without a fire sale or incurring a substantial loss. We classify loans that are relatively easier and less expensive to dispose of as semiliquid. For example, residential mortgages and consumer loans are relatively easy to sell to the national securitisation house, Cagamas. It is also relatively easy to sell loans made to other banking institutions, government and statutory bodies because the counterparties are generally established and informationally transparent. For the "*Mat*" liquidity creation measures, our dataset allows us to classify all loans with a remaining contractual maturity of less than one year as semiliquid, while loans with a remaining maturity of more than one year are classified as illiquid.

   As for other bank assets for which maturity is not applicable, we classify these items in the exact same way as the "*Cat*" approach. Similarly to loans, asset items that typically cannot be liquidated quickly without incurring a substantial cost are classified as illiquid. These illiquid assets include property and equipment, investment in subsidiaries, joint ventures and associates and intangible assets. Assets such as cash, due from banks, securities, derivative assets and other marketable assets are classified as liquid because these items can be converted to cash quickly without incurring a major loss.

b. Liabilities and equity

   All transaction and savings deposits as well as money market deposits are classified as liquid liabilities as they can be withdrawn from banks almost instantly and cheaply, as compared to term deposits and other short-term borrowed money. Hence, for the "*Cat*" measures, term deposits are classified as semiliquid because all term deposits, regardless of their maturity, cannot be withdrawn without incurring a penalty. For the "*Mat*" measures, term deposits with a remaining contractual maturity of less than six months are grouped as liquid liabilities, between

six to twelve months are grouped as semiliquid liabilities, and greater than one year are treated as illiquid liabilities. We treat subordinated term loans, due to subsidiaries, equity and other liabilities that generally cannot be withdrawn from the bank without incurring a substantial cost as illiquid. Although some creditors and investors are able to sell their claims on the bank, the fund they retrieve is from new investors elsewhere, not from the bank. Thus, these liabilities and equity are illiquid from the bank's perspective.

c. Off-balance sheet activities

Off-balance sheet credit-related commitments and contingencies become functionally similar to on-balance sheet business loans when the funds must be provided by the bank upon the customer's demand. These illiquid bank commitments include direct credit substitutes, unutilised credit card lines, forward purchase commitments and contingent liabilities. Any loan commitments that can be unconditionally cancelled at any time by the bank are classified as semiliquid.

4.3.1.2 Step two: assign weights to the activities classified in step one

All balance sheet activities classified in step one are assigned a weight of $\frac{1}{2}$, 0 or $-\frac{1}{2}$ in consistency with the liquidity creation theory that both sources and uses of funds contribute equally to liquidity creation (Berger & Bouwman, 2009). Maximum liquidity is created for the nonbank public when the bank finances its illiquid assets by liquid liabilities, so a positive weight of $\frac{1}{2}$ is assigned to illiquid assets and liquid liabilities, respectively, in order to attribute half of the total liquidity creation amount to the sources of funds and the other half to the uses of funds. For illustration, assume a bank does not maintain liquid reserves, the bank creates a maximum of one hundred dollars of liquidity for the public when one hundred dollars of demand deposit placed with the bank is used to fund one hundred dollars of commercial loan for borrowers. A mathematical expression of this liquidity creation activity is \$100* $\frac{1}{2}$ +\$100* $\frac{1}{2}$ = \$100. The same logic applies whereby illiquid liabilities, equity and liquid assets are assigned a weight of $-\frac{1}{2}$ because when illiquid liabilities or equity is used to finance liquid assets, maximum liquidity is withdrawn by the bank from the public. A weight of 0 is assigned to semi-liquid assets and liabilities, assuming semi-liquid activities fall halfway between liquid and illiquid activities. In addition, illiquid off-balance sheet activities are weighted $\frac{1}{2}$ because they function similarly to on-balance sheet business loans when they are called on demand.

4.3.1.3 Step three: combine activities as classified in step one and as weighted in step two

Lastly, the weights of $\frac{1}{2}$, 0 or $-\frac{1}{2}$ assigned in step two are multiplied by the MYR values of the respective balance sheet items, then the weighted MYR values are summed up to arrive at the total MYR value of liquidity creation by each bank.

This study normalises the MYR amount of liquidity creation by total assets for each bank before including them in the regression models. Normalisation by total assets is necessary to allow meaningful comparisons of liquidity creation across banks and to avoid giving undue weight to the large banks (Berger & Bouwman, 2009). Regressing liquidity creation without normalisation can amount to regressing bank size on bank competition and other explanatory variables. We label our four alternative bank liquidity creation measures after their respective construction approach as *CATFAT_TA*, *CATNONFAT_TA*, *MATFAT_TA* and *MATNONFAT_TA*. More specifically, *CATFAT_TA* indicates total bank on- and off-balance sheet liquidity creation measure based on "*Cat*" classification approach; *CATNONFAT_TA* is total bank on-balance sheet liquidity creation measure based on "*Cat*" classification approach; *MATFAT_TA* is total bank on- and off-balance sheet liquidity creation measure based on "*Mat*" classification approach; *MATNONFAT_TA* is total bank on-balance sheet liqudidity creation measure based on "*Mat*" classification approach. This study also uses *OFFLC_TA* as an additional measure of bank liquidity provision through off-balance sheet components only.

We agree with Berger and Bouwman (2009) that "*CATFAT_TA*" provides a more precise bank liquidity creation approximation as compared with the other three measures for two main reasons. First, the "*Cat*" measures are preferred to the "*Mat*" measures because, in practice, banks create liquidity for the non-bank public mainly through a liquidity transformation mechanism, rather than through maturity transformation. For instance, a 10-year residential mortgage is more liquid than a 10-year commercial loan from the bank's point of view because the residential mortgage can be securitised and sold easily. Similarly, term deposits are not as liquid as transaction or savings deposits because a penalty can be imposed on early withdrawal of term deposits regardless of their maturity. Second, the "*fat*" measures are preferred over the "*nonfat*" measures because banks in this innovative financial era carry out their liquidity creator role not only through traditional on-balance sheet activities, but also increasingly through off-balance sheet activities, such as through loan commitments that serve similarly to business loans when they are called on demand. Hence, "*CATFAT_TA*" is our preferred liquidity creation measure.

4.3.2 Measurement of bank competition

There are two divisions of empirical approaches to measuring bank competition in the literature, namely the traditional industrial organisation (IO) method that focuses on the structural approach and the new empirical IO method that focuses on the non-structural approach (Degryse & Ongena, 2008). The structural approach was popular in the structure-conduct-performance (SCP) and efficient-structure (ES) research until the early 1990s. The SCP hypothesis posits that high bank market concentration entitles incumbent banks to a certain degree of market power, allowing them to behave non-competitively and earn monopolistic profits. The ES hypothesis, on the other hand, suggests that bank efficiency is a determinant of bank performance which in turn affects the market share of the bank and bank market concentration. Both SCP and ES studies assume that greater bank market concentration is associated with greater market power or inversely related to bank competition, which is, however, not always the case. Examples of structural bank market power measures include the Herfindahl-Hirschman index (HHI) and the market share of the n-largest banks in the banking sector.

The use of the structural approach has been widely criticised by the new empirical IO researchers because it overemphasises the market structure over the bank's behaviour that drives its market power (Aghion et al., 2005; Borenstein & Bushnell, 1999; Carbó-Valverde et al., 2009; Connor & Peterson, 1992; Dell'Ariccia, 2001). Generally, the new empirical IO advocators assert that the non-structural approach is superior to the structural approach in two main ways. First, the structural approach fails to consider the elasticity of demand for the bank's products and services. With growing financial liberalisation, for instance, through relaxations of (foreign) bank entry and activity restrictions, bank competition has become less sensitive to market structure, but more sensitive to the bank's contestability (Claessens & Laeven, 2004; Connor & Peterson, 1992; Borenstein & Bushnell, 1999). Carbó-Valverde et al. (2009) documented that the structural approach lacks consistency and robustness in measuring market power and does not produce similar results to the non-structural approach. However, after controlling for the elasticity of demand and market contestability, the conflicting results can be reconciled. Second, the structural approach relies heavily on the geographic and product market definitions of banks, thus, the bank competition measure is confined to the defined market at an aggregate level. Since banks today often operate across national borders and compete with banks in other countries, the non-structural approach overcomes this issue by measuring bank market power directly (Aghion et al., 2005; Joh & Kim, 2012).

The commonly used non-structural bank competition measures are the Lerner index of market power, the Panzar-Rosse (PR) H-statistic and the Boone indicator. In this study, we employ the Lerner index as an inverse proxy for bank competition because the Lerner index of market power measures bank competition at the bank level, while the PR H-statistic and the Boone indicator measure bank competition at the aggregate market level (Berger et al., 2009; Horvath et al., 2013, 2016). It is important to have this characteristic because our study is interested in bank-level investigation of the relationship between bank competition and liquidity creation[28].

The Lerner index of market power measures the difference between average price and marginal costs of output as a ratio to average price (Lerner, 1934). The Lerner index is the inverse of the elasticity of demand of a monopolist when the monopolist maximises its monopoly revenue in an equilibrium where marginal costs coincide with marginal revenues. However, as maximum monopoly revenue is not always obtained in practice, the Lerner index must be read "not as potential monopoly, but as monopoly in force" (Lerner, 1934, p.170)[29]. In the context of banking, the Lerner index of market power captures the exercised pricing power of the bank to mark up the price over the marginal cost of its output. In other words, the higher the Lerner index of a bank, the lower the competition facing the bank. The Lerner index is mathematically expressed as:

$$LERNER_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (1)$$

where P_{it} is the observed average price of bank output, measured by the total revenues divided by the total assets for bank *i* at time *t*, and MC_{it} is the marginal cost of bank output for bank *i* at time *t*. Following Angelini and Cetorelli (2003), de Guevara et al. (2005), Demirguc-Kunt and Martinez Peria

[28] For brevity's sake, we briefly introduce the concepts of the PR H-statistic and the Boone indicator. The PR H-statistic captures the elasticity of bank revenues to input prices. Unlike the Lerner index, the PR H-statistic is not a continuous measure of market power with greater values implying higher levels of market power or lower bank competition. The PR H-statistic is only useful for diagnosing the competition regime of a banking industry (Shaffer, 2004). A banking market is characterised as monopoly if $H < 0$, as perfect competition if $H = 1$, and as monopolistic competition if $0 < H < 1$.
On the other hand, the Boone indicator infers the level of bank market competition based on the elasticity of bank performance measured in terms of either profits or market share to marginal costs (Boone, 2008; Mirzaei & Moore, 2014; van Leuvensteijn et al., 2011). The rationale behind Boone's indicator is that the effect of output reallocation from less-efficient banks (banks with higher marginal costs) to more-efficient banks (banks with lower marginal costs) is stronger in an intensely competitive market. This implies that a competitive market improves the performance of more-efficient banks and impairs the performance of less-efficient banks. Thus, the stronger the effect of marginal costs on performance (the more negative the Boone indicator), the higher the degree of the market competition.

[29] A monopolist does not obtain maximum monopoly revenue in practice for numerous reasons, which may be accidental, as when the monopolist does not know the shape of its demand curve and his estimate of the elasticity of demand at the actual output is erroneous, or intentional in virtue of social or philanthropic reasons or for the purpose of avoiding political opposition or new competitors (Lerner, 1934).

(2010), Hainz et al., 2013; Shaffer (1993) and Turk-Ariss (2010), total assets is used to account for the aggregate output of the bank under the assumption that the heterogeneous flow of products and services produced by a bank is proportional to its total assets.

MC_{it} is derived from estimation of a translog cost function. This study employs the translog cost function of one output, three input prices and time trend, following existing studies of bank competition, such as Berger et al. (2009), de Guevara et al. (2005), de Guevara and Maudos (2011), Hainz et al. (2013), Horvath et al. (2013, 2016), Love and Martinez Peria (2013) and Turk-Ariss (2010). Input prices and output quantities are assumedly exogenous elements in a bank's cost-minimising decision process. A time trend variable is introduced into the cost function to capture the changes in the total cost and the slope coefficients of output and input prices over time resulting from the technological development. As given by equation (2), a cost function should be linear in the first-order exogenous input prices, output and trend factors and concave in the input prices, and should allow for U-shaped average cost and rotation of cost to changes in the exogenous factors (Murray & White, 1983; Shaffer, 1993).

$$\ln TC_{it} = \alpha_{0i} + \alpha_1 \ln Q_{it} + \frac{1}{2}\alpha_2 (\ln Q_{it})^2 + \sum_{j=1}^{3} \beta_j \ln w_{jit} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \gamma_{jk} \ln w_{jit} \ln w_{kit} + \sum_{j=1}^{3} \delta_{jq} \ln w_{jit} \ln Q_{it} + \lambda_1 Trend + \frac{1}{2}\lambda_2 Trend^2 + \lambda_3 Trend \ln Q_{it} + \sum_{j=1}^{3} \pi_j Trend \ln w_{jit} + e_{it} \quad (2)$$

where

i denotes individual bank and *t* denotes specific year;

TC = bank total operating costs measured by the sum of interest, operating, administrative and personnel expenses;

Q = bank total output proxied by total assets;

w_j = input prices of deposits, fixed capital and labour;

Trend = time trend;

e = idiosyncratic error term;

α, β, γ, δ, λ and π are coefficients to be estimated.

Two theoretical restrictions are imposed on the cost function, namely linear homogeneity and symmetry restrictions on input prices (Benston et al., 1982; de Guevara et al., 2005; Hainz et al., 2013; Horvath et al., 2013, 2016; Love & Martinez Peria, 2013; Murray & White, 1983; Turk-Ariss, 2010). The bank's cost function is assumed to be homogeneous of degree one in all input prices, that is, a proportional increase in all input prices increases the cost by the same proportion, holding other

exogenous factors constant. In this case, the sum of own and cross price elasticities of cost is equal to zero. Specifically, linear homogeneity assumption requires that:

(a) $\sum_{j=1}^{3} \beta_j = 1$,

(b) $\sum_{j=1}^{3} \delta_{jq} = 0$,

(c) $\sum_{j=1}^{3} \pi_j = 0$, and

(d) $\sum_{j=1}^{3} \gamma_{jk} = 0$.

Standard symmetry is imposed through the restriction $\gamma_{jk} = \gamma_{kj}$ for all $j \neq k$ to allow for symmetric cross price response (Benston et al., 1982; Murray & White, 1983; Zardkoohi et al., 1986). We impose the restrictions by scaling total cost and input prices by one input price, following Adjei-Frimpong et al. (2015), Hainz et al. (2013) and Turk-Ariss (2010). The restricted translog cost function is specified as:

$$\begin{aligned} \ln TC_{it}^{*} = {} & \rho_{0i} + \rho_1 \ln Q_{it} + \frac{1}{2}\rho_2 (\ln Q_{it})^2 + \theta_1 \ln w_{1it}^{*} + \theta_2 \ln w_{2it}^{*} + \frac{1}{2}\tau_{11} (\ln w_{1it}^{*})^2 + \tau_{12} \ln w_{1it}^{*} \ln w_{2it}^{*} \\ & + \frac{1}{2}\tau_{22} (\ln w_{2it}^{*})^2 + \mu_{1q} \ln w_{1it}^{*} \ln Q_{it} + \mu_{2q} \ln w_{2it}^{*} \ln Q_{it} + \varphi_1 Trend + \frac{1}{2}\varphi_2 Trend^2 + \vartheta_1 Trend \ln w_{1it}^{*} \\ & + \vartheta_2 Trend \ln w_{2it}^{*} + \vartheta_3 Trend \ln Q_{it} + e_{it} \end{aligned} \quad (3)$$

where

i denotes individual bank and *t* denotes specific year;

TC^{*} = total operating costs scaled by w_3;

Q = total outputs proxied by total assets;

w_1 = input price of deposits, measured as the ratio of interest expenses to total deposits for commercial banks or the ratio of income paid to depositors to total deposits for Islamic banks;

w_2 = input price of fixed capital, measured as the ratio of operating and administrative expenses (excluding personnel expenses) to total fixed assets;

w_3 = input price of labour, measured as the ratio of personnel expenses to total assets;

w_1^{*} = measured by w_1/w_3;

w_2^{*} = measured by w_2/w_3;

Trend = time trend;

e = idiosyncratic error term;

ρ, ϑ, τ, μ, φ and θ are coefficients to be estimated.

We estimate the restricted translog cost function (equation 3) using two different bank datasets: (i) a combined dataset of 397 bank-year observations from 27 commercial banks and 16 fully fledged Islamic banks, and (ii) a dataset of 294 bank-year observations only from 27 commercial banks. We prefer the first dataset in the estimation of bank marginal cost given the consideration that Islamic banks that obey the Syariah-compliant commercial bank regulations are growing players in the commercial banking industry in Malaysia. Introducing Islamic banks into the cost function estimation provides more accurate knowledge about the cost behaviour of the industry, which allows more precise estimation of the market power of individual commercial banks. We assume that Islamic banks employ almost the same technology as conventional commercial banks and that it is appropriate to jointly assess the cost function of these banks, in line with the studies of Abdul-Majid et al. (2009), El-Gamal and Inanoglu (2005) and Love and Martinez Peria (2013). However, we also estimate the cost function using only conventional bank data (second dataset) to perform a robustness check for our empirical results in Chapter Five. A fixed effects estimator is used to estimate the restricted translog cost function (equation 3) to capture unobserved bank effects that may correlate with other explanatory variables and cause biases in the estimated coefficients. The regression is estimated with robust standard errors, clustered by bank, to control for cross-sectional heteroscedasticity and serial correlation within the bank.

Next, the marginal cost for each bank-year observation is calculated after taking the first derivative of the translog cost function with respect to *Q* as follows:

$$MC_{it} = \frac{d(\ln TC^{*}_{it})}{d(Q_{it})} = \frac{TC_{it}}{Q_{it}}\left[\rho_1 + \rho_2 \ln Q_{it} + \mu_{1q} \ln w^{*}_{1it} + \mu_{2q} \ln w^{*}_{2it} + \vartheta_3 Trend\right] \quad (4)$$

where coefficients ρ_1, ρ_2, μ_{1q}, μ_{2q} and ϑ_3 are estimated from equation (3). Finally, the Lerner index for each bank-year observation is calculated using equation (1). We label the calculated Lerner index using a combined dataset of commercial and Islamic banks as *LERNER* and the calculated Lerner index using only commercial bank data as *LERNER1*.

4.3.3 Measurement of stock market liquidity

Financial market liquidity is an elusive concept and should exhibit the dimensions of tightness, immediacy, depth, breadth and resiliency which are always interrelated to some degree (Sarr & Lybek, 2002). No single measure has been able to capture all these dimensions, and very often, the information needed to measure these dimensions is not publicly available. Therefore, a wide range of substitute market liquidity measures have been developed, and in general, these measures can be categorised into transaction cost measures, volume-based measures, price impact measures and

other measures. These financial market liquidity measures usually capture a dimension of market liquidity and indirectly imply other dimensions.

Since our study does not have intraday stock data for Malaysia, we make use of several low frequency liquidity measures that have been widely employed for developing or emerging stock markets (Lesmond, 2005; Kang & Zhang, 2014; Wang, 2013). These market liquidity measures include proportional quoted bid-ask spread, Amihud's (2002) illiquidity ratio, turnover ratio and frequency of zero return days. Because liquidity of a financial market depends on the substitutability among the various assets traded on the particular market, the measurement of market liquidity is often derived from the average liquidity of the assets on the market (Lesmond, 2005; Kang & Zhang, 2014; Pastor & Stambaugh, 2003; Sarr & Lybek, 2002; Wang, 2013). Hence, our annual stock market liquidity measures are constructed by taking the average of the liquidity measure across all the stocks traded in the year.

4.3.3.1 Quoted bid-ask spread

The quoted bid-ask spread is the most common transaction cost measure that captures the execution cost of completing a round-trip trade (buy and sell) of a financial asset (Bessembinder & Venkataraman, 2010; Fleming, 2003; Huang & Stoll, 1996). Although the bid-ask spread better reflects the transaction costs in a dealer market, particularly order-processing costs, asymmetric information costs and inventory-carrying costs, it is useful to apply the bid-ask spreads to a broker market like Bursa Malaysia to obtain approximations of the transaction costs that investors ought to recover on the market (Gabrielsen et al., 2011; Sarr & Lybek, 2002). A low bid ask spread of a stock implies that the stock allows investors to get in or out of the investment without losing substantial capital in the process.

Daily quoted bid and ask prices of stocks obtained from the DataStream database are daily best bid and ask prices quoted at close of the market. Bid and ask prices are not reported on public days and weekends. The quoted bid-ask spread of a stock is expressed as a percentage of its bid-ask midpoint that represents the true underlying stock value for easier comparisons of transaction cost across stocks and time (Bessembinder & Venkataraman, 2010; Sarr & Lybek, 2002).

$$QSPPROP = \frac{(P_A - P_B)}{((P_A + P_B)/2)}$$

where P_A is the quoted ask price and P_B is the quoted bid price. The average *QSPPROP* of the stock market in a particular year is then calculated by averaging daily *QSPPROP* of all stocks over the year. Higher *QSPPROP* implies lower stock market liquidity.

QSPPROP assumes that stock trades are executed at the quoted prices. This assumption, however, carries a limitation because stock trades may take place inside the quoted spread (Gabrielsen et al., 2011; Huang & Stoll, 1996). The quoted spread will overestimate the actual transaction cost when trades are executed inside the spread. Given such consideration, it is important to remove extreme outliers (Sarr & Lybek, 2002). We define an extreme outlier as a proportional bid-ask spread that exceeds 80 percent, in consistency with Lesmond's (2005) study of the emerging market. We also trim missing and unavailable ask or bid quotes and negative bid-ask spread quotes that could result from keypunching errors or other unusual cases, following Chordia et al. (2005), Huang and Stoll (1996), Lesmond (2005) and Kang and Zhang (2014). These filters affect about two percent of the total 2,969,913 daily bid-ask spread quotes in our stock sample.

4.3.3.2 Turnover ratio

Turnover ratio of a stock market measures the frequency at which outstanding shares are traded in the market (Lesmond, 2005; Sarr & Lybek, 2002). It is a ubiquitous but indirect measure of market liquidity that assumes that an actively traded market is associated with low trading costs in the market (Demirgüç-Kunt & Levine, 1996a). In times when stock prices move smoothly, turnover ratio is useful to reflect the market breath as a high stock turnover ratio implies the existence of abundant and large orders in volume with minimal impact of stock prices. However, during periods of high stock price volatility, this measure no longer reflects changes in the trading costs because stocks change hands quickly and in large volume to adjust prices sharply in response to the arrival of new information, which impedes the market liquidity (Fleming, 2003; French & Roll, 1985; Lesmond, 2005; Rouetbi & Mamoghli, 2014).

Annual data of the turnover value and market capitalisation for the stock market are readily available on the BNM website (http://www.bnm.gov.my/). The stock market turnover ratio of the year is calculated as:

$$STURNOVER = \frac{VA}{AMC}$$

where *VA* is the total value of shares traded over the year in MYR million and *AMC* is the average market capitalisation in MYR million at the beginning and end of the year. We then average the annual turnover ratio (*STURNOVER*) by the number of trading days (D_t) in the year to obtain the

average daily market turnover ratio (*DTVR*) for our empirical analysis. Higher *DTVR* implies higher stock market liquidity.

4.3.3.3 Amihud's (2002) illiquidity ratio

Amihud's (2002) illiquidity ratio measures the daily price response of a stock to its order flow. Owing to the capability of Amihud's illiquidity ratio in capturing the ability of stocks (or stock markets) to absorb large transactions without any significant price fluctuations, it is a useful measure of the breadth and depth of stocks (or stock markets). Amihud's (2002) illiquidity ratio of a stock is defined as the average ratio of the absolute daily return (*r*) to the trading volume (*VA*) in MYR value on that day over all available trading days (D_t) of the stock in the year:

$$AMIHUD = \frac{1}{D_t}\sum_{t=1}^{Dt}\frac{|r_t|}{VA_t}$$

Daily stock prices and volume are obtained from the DataStream database. Prior to calculating Amihud's (2002) illiquidity ratio for stocks, this study follows Lesmond et al (1999), Lesmond (2005), Chordia et al. (2001, 2005) and Huang and Stoll (1996) and applies the following data filters on our stock sample:

(i) A stock in the year is excluded if its listing or delisting happened mid-year, meaning that only stocks that are listed on Bursa Malaysia for the entire year are included;

(ii) Stock prices of the day and the prior day are excluded if the stock return of the day is above ±50 percent (inclusive); and

(iii) A stock in the year is discarded if the stock is traded less than 20 percent of total trading days during the year (about 50 trading days in a year). Every stock must have a sufficiently large number of observations in a year.

After obtaining *AMIHUD* for all stocks, we trim the upper and lower one percent of the standardised *AMIHUD*'s distribution to remove the outliers (Amihud, 2002; Lesmond, 2005). To calculate the average market *AMIHUD* for a year, *AMIHUD* of stocks are averaged across all stocks in the year. The market *AMIHUD* is then multiplied by 10^6 to provide a common representation among the other stock market liquidity measures. The higher the market *AMIHUD*, the lower the stock market liquidity.

4.3.3.4 Zero returns

The relative frequency of trading days with zero returns over a period was first used by Lesmond et al. (1999) to proxy for illiquidity and transaction costs of a stock, before it became widely employed in stock market liquidity studies, for instance, Bekaert et al. (2007), Charoenwong (2014), Goyenko et al. (2009) and Kang and Zhang (2014). The rationale behind the measure is that a stock with high transaction costs is more likely to have fewer trades or low trade volume, and thus, has less frequent price movements. Investors are intensively demotivated to acquire private information on stocks that are expensive to trade as they are willing to trade on new information of the stocks only when the value of the information outweighs the transaction cost to yield a positive net return from the trade. Thus, zero daily returns occur frequently on illiquid stocks as no new information about the stocks is reflected on the stock prices.

$$ZERORET = \frac{number\ of\ days\ with\ zero\ returns\ in\ a\ year}{number\ of\ stock\ trading\ days\ in\ a\ year}$$

We calculate the percentage of zero return days in a year for all stocks and average them to obtain the average market illiquidity for the year. Similarly to the data filters (i) and (ii) applied to the Amihud's (2002) illiquidity ratio, a stock in the year is deleted if the stock's listing or delisting happened mid-year. Higher *ZERORET* implies lower stock market liquidity.

4.3.3.5 Aggregate stock market illiquidity index score

To ensure that our empirical results for stock market liquidity are rigorous, we develop an aggregate stock market illiquidity index score with the aim of capturing all dimensions of market liquidity in a single measure, using the Paasche index technique. The rationale behind our market illiquidity index is credited to Choudhry (2010) who devised composite aggregate liquidity scores for bond markets using different methodologies including the Paasche index technique. Our aggregate market illiquidity index score is computed from the four market liquidity measures identified above, *QSPPROP*, *AMIHUD*, *DTVR* and *ZERORET*. Since *QSPPROP*, *AMIHUD* and *ZERORET* are stock market illiquidity measures and *DTVR* is a measure of stock market liquidity, we perform an inverse transformation of *DTVR* in order to attribute higher *DTVR* to greater market illiquidity. The calculation of the market illiquidity index score is undertaken as follows. We, first, calculate index scores for each market illiquidity measure over the sample period using the final year value as the base value. Next, these component index series are aggregated using an equal weighting to arrive at a composite index series for the market (*PINDEX4*). Equal weight is assigned to all component index series as we assume that each measure of stock market liquidity is of equal usefulness. Higher *PINDEX4* implies lower stock market liquidity.

4.3.4 Measurements of control variables

Our control variables can be classified into (i) bank-specific characteristics, (ii) domestic banking and stock market conditions and (iii) macroeconomic factors. The definitions of these control variables are tabulated in Table 5.1 in Chapter Five.

4.3.4.1 Bank-specific control variables

Bank-specific control variables used in the study include bank size, bank equity, bank risk, government ownership, merger and acquisition history and operation of the Islamic Banking Scheme. Berger et al. (2005a), Keeley (1990), Petersen and Rajan (2002) and Stein (2002) in the literature reported that the organisational form of the bank, which is determined by bank size, influences the kinds of activities the bank engages in and benefits from, such as information acquisition, lending technology specialisation and implicit government protection. Hence, we control for the effect of bank size, measured by the natural log of total assets (*lnTA*), on bank liquidity creation. Bank liquidity creation studies that include bank size in the regression models include Al-Khouri (2012), Berger and Bouwman (2009), Hackethal et al. (2010), Joh and Kim (2012) and Lei and Song (2013).

Controlling for bank equity capital ratio (*EQR*) measured by the total equity as a proportion to total assets, is important because prior literature has documented two opposing hypotheses for the effect of bank capital on liquidity creation (Berger & Bouwman, 2009; Diamond & Rajan, 2001; Horváth et al., 2014). Under the "financial fragility-crowding out" hypothesis, an increase in bank capital crowds out deposits that discipline a bank from withholding efforts to enhance depositors' welfare, creating a less fragile capital structure in the bank. As a result, the bank has less incentive to issue credit and create less liquidity. In contrast, the alternative "risk absorption" hypothesis predicts a positive relationship between bank capital and liquidity creation because an increase in bank capital helps to expand the bank's risk-bearing capacity.

In addition, our study controls for bank risk using two risk measures. Following Berger and Bouwman (2009), Berger et al. (2009) and Horvath et al. (2013, 2016), the first measure is the distance to insolvency (*ZSCORE*), computed by dividing the sum of the return on assets *(ROA*) and the equity to asset ratios by the standard deviation of *ROA*, $ZSCORE = \frac{(ROA + Equity / Assets)}{\sigma_{ROA}}$. *ZSCORE* can also be interpreted as an aggregate score of the bank's profitability, capitalisation and return volatility. The higher the *ZSCORE* of a bank, the lower the bank's insolvency risk. Berger and Bouwman (2009) documented a positive relationship between *ZSCORE* and bank liquidity creation

for large banks and an inverse relationship for small banks in the U.S. The findings imply that large banks create more liquidity when facing less default risk, while small banks are more active in creating liquidity when facing a higher default risk. Horvath et al. (2013, 2016) also found a negative relationship between *ZSCORE* and bank liquidity creation. The second risk measure is credit risk (*CREDIT_RISK*), measured as the ratio of risk-weighted assets to total assets of bank, following Berger and Bouwman (2009) and Horvath et al. (2013). *CREDIT_RISK* controls for the risk the bank is bearing when extending credit to borrowers.

Almost all the domestic commercial banks in Malaysia have ownership claims by Malaysian government-linked investment companies (GLICs). Despite the government allegedly not interfering with the management of these government-linked banks, products offered by these banks may carry a perceived implicit guarantee or any political influence that can lead to an imbalanced development of the banking industry (Dinç, 2005; World Bank, 2013). Hence, this study controls for the proportion of shares held in a bank by government-linked companies and agencies (*GLCOWN*).

Since there was a consolidation surge in the domestic banking industry in the early sample period, a dummy variable is introduced to control for the merger and acquisition history (*MA*) of the bank because the bank's conduct, strategies, reserve holdings and asset portfolios often change substantially following merger and acquisition (Berger & Bouwman, 2009; Carletti et al., 2007; Joh & Kim, 2012; Sapienza, 2002). The *MA* dummy variable takes the value of one if the bank was involved in at least one merger or acquisition with other banking institutions over the past three years, and zero otherwise.

Under the Islamic Financial Services Act 2013, Islamic banking businesses are operated either by fully-fledged Islamic banks or through the Islamic Banking Scheme (IBS) under a conventional commercial bank. Since several commercial banks in our sample provide IBS business, a dummy variable for IBS (*IBSDUMMY*) is introduced to control for the influence of IBS on liquidity creation by these commercial banks, although the influence is marginal.

4.3.4.2 Banking and stock market-specific control variables

To control for the structure of the local banking market, this study employs the Herfindahl–Hirschman index of bank deposits (*HHI_D*) that measures the concentration level of the deposit market in which banks compete for deposits. Empirical works that have shown bank market concentration influences bank liquidity creation and credit availability to firms include Berger and

Bouwman (2009), Carbó-Valverde et al. (2009), Joh and Kim (2012), Love and Martinez Peria (2013) and Petersen and Rajan (1995).

This study also employs stock market capitalisation to gross domestic product ratio (*SCAPRATIO*) to control for possible influence of the overall development of the Malaysian stock market. Bencivenga et al. (1995), Demirgüç-Kunt and Maksimovic (1996), Dey and Flaherty (2005) and Levine (1991) have reported that stock market development exerts a setback for the development of the banking industry, for instance, in the aspects of firms' financing choices and bank profitability.

4.2.4.3 Macroeconomic control variables

To control for interest rate environment, we use real overnight interbank rate to proxy for the monetary policy set by BNM (*MP*). It has been statistically shown that a tighter monetary policy reduces liquidity creation by banks, especially by smaller banks (Berger & Bouwman, 2012; Chatterjee, 2015; Fungácová et al., 2013a; Hackethal et al., 2010). A restrictive monetary policy implies that the short-term refinancing costs of banks become more expensive in the case of unanticipated liquidity strain. This prompts banks to maintain more liquid reserves within themselves and ration credit supply in the private sector, resulting in an overall drop of liquidity creation by banks (Hackethal et al., 2010). In addition, a restrictive monetary policy reduces economic activity and demand for bank credit as it subsequently affects a rise in market interest rates (ECB, 2012).

Controlling for real macroeconomic growth (*GDPRATE*) is also important because economic growth can alter liquidity creation by banks through changes in the balance sheet activities (Beck et al., 2004; Fungácová et al., 2013; Joh & Kim, 2012). Finally, this study includes a dummy variable to control for the impact of the 2008 global financial crisis (*CRISISDUMMY*) on bank liquidity creation. Since the crisis unfolded in late 2007 and lasted till late 2009, *CRISISDUMMY* takes the value of one for bank observations falling in the years 2007, 2008 and 2009, zero otherwise.

4.4 Empirical model

To examine the empirical relationships of interest, this study employs the fixed effects estimator, following existing bank liquidity creation studies, such as Berger and Bouwman (2009), Joh and Kim (2012) and Xu (2010). The fixed effects estimator is preferred over the random effects estimator because the fixed effects estimator is more consistent in estimating *ceteris paribus* effects in the presence of unobserved individual fixed effects (a_i) that correlate with the explanatory variables.

Such a correlation can induce endogeneity bias to the estimation. By removing a_i through a transformation, the fixed effects estimator is robust to the endogeneity bias (Wooldridge, 2013). Since the sample in this study covers most of the commercial banks in Malaysia, it is not a random sample representing a subset of the bank population. As such, we cannot confidently assert no correlation between a_i and any explanatory variable as assumed by the random-effects estimator[30].

The baseline regression model of our study is written in equation (5).

$$LC_{it} = \beta_1 LERNER_{it} + \beta_2 SLIQUIDITY_{it} + \beta_3 X_{it} + a_i + u_{it} \quad (5)$$

where

i denotes individual bank and *t* denotes specific year;

LC = bank liquidity creation measures as a proportion of total assets;

LERNER = bank market power as an inverse proxy for bank competition;

SLIQUIDITY = stock market liquidity measures;

X = a vector of control variables including *EQR*, *lnTA*, *CREDIT_RISK*, *ZSCORE*, *GLCOWN*, *MA*, *IBSDUMMY*, *HHI_D*, *SCAPRATIO*, *MP*, *GDPRATE* and *CRISISDUMMY*

a = time-invariant unobserved individual effect;

u = idiosyncratic error term;

β = coefficients to be estimated.

The fixed effects estimator uses the within transformation to eliminate unobserved individual fixed effects. The transformation, first, requires computation of the sample average of variables over time for each bank, as shown below:

$$\overline{LC_i} = \beta_1 \overline{LERNER_i} + \beta_2 \overline{SLIQUIDITY_i} + \beta_3 \overline{X_i} + a_i + \overline{u_i} \quad (6)$$

Equation (6) is then subtracted from equation (5) for each *t* to obtain time-demeaned equation (7):

$$LC_{it} = \beta_1 LERNER_{it} + \beta_2 SLIQUIDITY_{it} + \beta_3 X_{it} + u_{it} \quad (7)$$

where LC denotes the time-demeaned liquidity creation, and the same notation is used for each explanatory variable and idiosyncratic error term. The most important thing about the transformed equation (7) is that the fixed effect (a_i) drops out.

We examine our first research objective by estimating our regression model (see equation 5) using two subsamples of Malaysian commercial banks - small banks and large banks. We examine research

[30] We perform Hausman's (1978) test, and the result confirms that the fixed-effects estimator provides more consistent estimates for this study than does the random-effects estimator.

objectives two and three simultaneously by running the regression model using the full sample banks. In consistency with previous bank liquidity creation studies, our regression model is estimated with robust standard errors, clustered by bank, to control for cross-sectional heteroscedasticity and serial correlation within the bank. The usual standard errors reported by the fixed effects estimator are no longer valid in violations of the heteroscedasticity and serial correlation assumptions of the estimator (Wooldridge, 2013).

Chapter 5

Empirical Results and Discussions

5.1 Introduction

This chapter comprises four sections. Section 5.2 presents descriptive statistics of all variables used in this study and shows the changes of our variables of interest, particularly bank liquidity creation, bank competition and stock market liquidity. Section 5.3 shows the baseline regression results of the empirical models, and Section 5.4 reports the results of the additional tests. Section 5.5 discusses the results with the support of previous studies.

5.2 Descriptive statistics

This section presents the descriptive statistics of variables used in this study. Table 5.1 defines and summarises the bank liquidity creation measures and explanatory variables used in this study. Descriptions of these variables are in Chapter 4. Table 5.2 presents the average bank liquidity creation for the full bank sample and separately for large bank and small bank samples over the years 2001 to 2013, based on *CATFAT*, *CATNONFAT*, *MATFAT* and *MATNONFAT* liquidity creation measures. The magnitude of bank liquidity creation is expressed both in real 2013 MYR and as a proportion of total assets. Table 5.2 also includes graphs of average bank liquidity creation over the sample period for the corresponding measures. Based on the results in Table 5.2, the MYR amount of liquidity creation computed using the "maturity" classification (*MATFAT* and *MATNONFAT*) is greater than the "category" classification (*CATFAT* and *CATNONFAT*). This is not surprising because the standard we use to classify the liquidity of banks' balance sheet activities is more stringent with the "category" approach.

Table 5.2 reveals several interesting facts about bank liquidity creation in Malaysia. Irrespective of liquidity creation measures, the average liquidity creation of all commercial banks, measured in real 2013 MYR, increased precipitately from the year 2001 to 2013. For example, based on *CATFAT*, average bank liquidity creation increased by about 44 percent from MYR 13.7 billion in 2001 to MYR 19.7 billion in 2013. When looking closely at the banks of different size classes, upward trends of liquidity creation are observed for large banks for all four liquidity creation measures throughout the period, as compared to small banks which exhibited rather erratic patterns and decreased from the year 2001 to 2013. The relative liquidity creation of large and small banks reflects that a majority of the liquidity in the non-bank sectors in Malaysia was created by large banks.

To avoid giving undue weight to large banks, Table 5.2 also presents bank liquidity creation as a proportion of bank total assets numerically and graphically. We find that, regardless of the bank size classes, all the proportional bank liquidity creation measures exhibited faltering movements throughout the years 2001 to 2013, except the less stringent proportional *MATFAT* and *MATNONFAT* liquidity creation of large banks that showed a moderate rise over the same period. In other words, the growth of proportional bank liquidity creation of small banks was as obscure as their liquidity creation in MYR amount, and the growth of proportional bank liquidity creation of large banks was stubbornly low as compared to their rapidly growing liquidity creation in MYR amount. These findings, thus, suggest that, on the average, bank liquidity creation had not grown as fast as bank total assets, which implies that the growth in bank total assets was increasingly supported by non-liquidity creation activities such as cash reserves.

Since business corporates have increasingly relied on banks' credit contingent and commitment products, it is important to analyse the extent to which bank liquidity creation is attributable to banks' off-balance sheet contingencies and commitments in relation to their on-balance sheet activities. Figure 5.1 displays the over-time changes of average bank liquidity creation by on-balance sheet (*CATNONFAT* and *MATNONFAT*) and off-balance sheet (*OFFLC*) components for (a) the full bank sample and separately for (b) large banks and (c) small banks. It is shown that off-balance sheet activities played a substantial role in the liquidity creation of banks over the sample period, but the extent of its contribution is dependent on the liquidity classification approach of bank activities. Based on our preferred "category" approach, the average contribution of *OFFLC* to total liquidity creation over the period ranges from 53 percent to 72 percent for the entire sample banks and from 52 percent to 71 percent for the large bank sample. However, based on the less stringent "maturity" approach, *OFFLC* contributed far less to the total liquidity creation of these banks, which was about 37 percent on the average. In contrast to large banks, irrespective of the "category" or "maturity" approach, the liquidity creation of small banks was mostly attributed to their off-balance sheet activities. As indicated by negative average *CATNONFAT* and *MATNONFAT* in Figure 5.1(c), on-balance sheet undertakings of small banks had been withdrawing liquidity in the non-bank sectors since the year 2004.

Table 5.1 Descriptive statistics of variables for the sample period 2001 to 2013

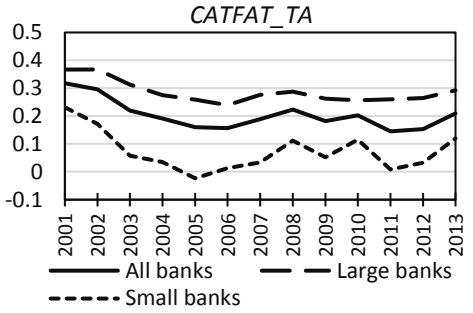
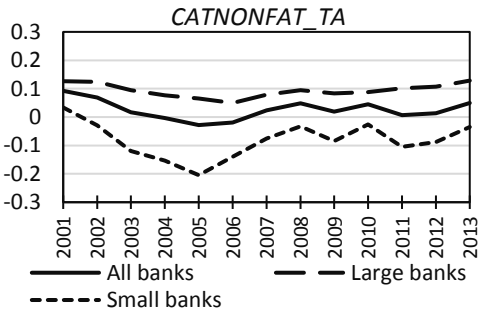
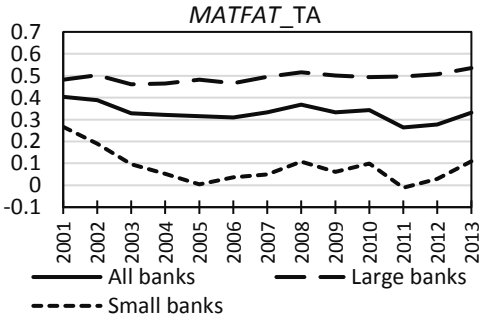
Variable	Definition	Mean	Std. deviation
Bank liquidity creation (*LC*)			
CATFAT_TA (preferred measure)	Total bank *LC* calculated from both on- and off-balance sheet items using the category approach. *LC* is scaled by total assets of bank	0.20	0.21
CATNONFAT_TA	Bank *LC* calculated from on-balance sheet items using the category approach. *LC* is scaled by total assets of bank	0.025	0.17
MATFAT_TA	Bank *LC* calculated from both on- and off-balance sheet items using the maturity approach. *LC* is scaled by total assets of bank	0.33	0.27
MATNONFAT_TA	Bank *LC* calculated from on-balance sheet items using the maturity approach. *LC* is scaled by total assets of bank	0.15	0.23
OFFLC_TA	Bank off-balance sheet *LC* calculated using the category approach. *LC* is scaled by total assets of bank	0.18	0.090
CATFATRM	Bank *LC* calculated using the same approach as above, except that *LC* is expressed in real 2013 MYR billions using the GDP price deflator	15.1	23.6
CATNONFATRM		5.74	12.2
MATFATRM		25.8	36.0
MATNONFATRM		16.4	25.2
OFFLCRM		9.35	12.2
Bank level market power	Lerner index: An inverse measure of bank competition that denotes the market power of bank in setting the mark-up price over the marginal cost		
LERNER	Lerner index estimated using a dataset of commercial and Islamic banks	0.28	0.23
LERNER1	Lerner index estimated using a dataset of commercial banks	0.26	0.23
Bank capital ratio			
EQR	Total equity capital as a proportion of total assets	0.13	0.090
Bank size			
lnTA	Natural log of total assets	9.95	1.59

Bank risk			
CREDIT_RISK	Credit risk measure: Risk-weighted assets divided by total assets	0.62	0.17
ZSCORE	Distance to bankruptcy: The sum of return on assets ratio (*ROA*) and equity to assets ratio divided by the standard deviation of *ROA*	29.5	19.3
Government ownership			
GLCOWN	Proportion of shares held in a bank by government-linked companies and agencies	0.098	0.18
Mergers and acquisitions			
MA	A dummy that equals one if the bank was involved in any bank mergers and acquisitions over the past three years, zero otherwise	0.12	0.32
Local banking market concentration			
HHI_D	Herfindahl–Hirschman index (HHI) based on bank deposits: The sum of the squared deposit market share of each bank in the year	0.11	0.006
CR3	Asset market share of the three largest banks in the year	0.47	0.029
Islamic banking scheme			
IBSDUMMY	A dummy variable that equals one if the bank operates Islamic Banking Scheme (IBS) business, zero otherwise	0.37	0.48
Stock market liquidity			
QSPPROP	The average daily quoted bid-ask spread in the year, in percentage	5.27	2.35
AMIHUD	The average daily ratio of absolute price change to turnover value in the year	11.3	9.95
DTVR	The average daily turnover ratio in the year, in percentage	0.13	0.033
ZERORET	Percentage of zero return days to total trading days in the year	38.4	4.42
PINDEX4	Paasche-based aggregate stock market illiquidity index score computed from the equally-weighted average of *QSPPROP*, *AMIHUD*, *DTVR* and *ZERORET*	107	39.0
Stock market capitalisation			
SCAPRATIO	Value of listed shares as a share of GDP in the year	1.42	0.20

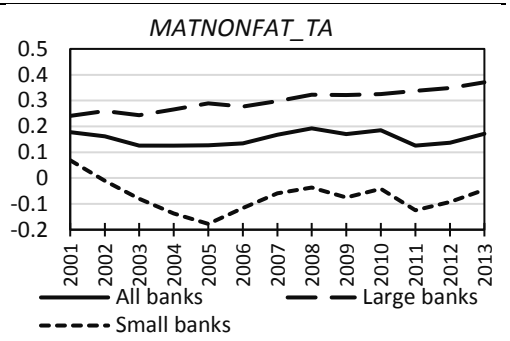
Local economic environment			
MP	Real overnight interbank rates	0.029	0.004
GDPRATE	Real GDP growth rate	0.048	0.023
2008 financial crisis			
CRISISDUMMY	A dummy variable that equals one for bank observations in 2007, 2008 and 2009; zero otherwise	0.22	0.42
Elements for *LERNER* computation			
w1	Price of deposits: Ratio of interest expenses to total deposits	0.025	0.011
w2	Price of fixed capital: Ratio of operating and administrative expenses (excluding personnel expenses) to total fixed assets	2.89	3.39
w3	Price of labour: Ratio of personnel expenses to total assets	0.007	0.002
P	Price of outputs: Ratio of total revenues to total assets	0.044	0.012
Instrumental variable			
FINANCIALFREE	Financial freedom score: A measure of independence from government control and interference in the financial sector	38.7	8.74
INVESTFREE	Investment freedom score: A measure of regulatory restrictions on the flow of investment capital	36.0	6.56
POLITICSA	Political stability and absence of violence: A measure of perceptions of political instability and politically-motivated violence, including terrorism	0.21	0.19
PROPERTYRIGHT	Property rights score: A measure of the degree to which a country's laws protect private property rights and are enforced effectively	50.8	1.82

Source: Author's calculations

Table 5.2 Summary statistics on average bank liquidity creation over the years 2001 to 2013 (in MYR billion and as a proportion of total assets)

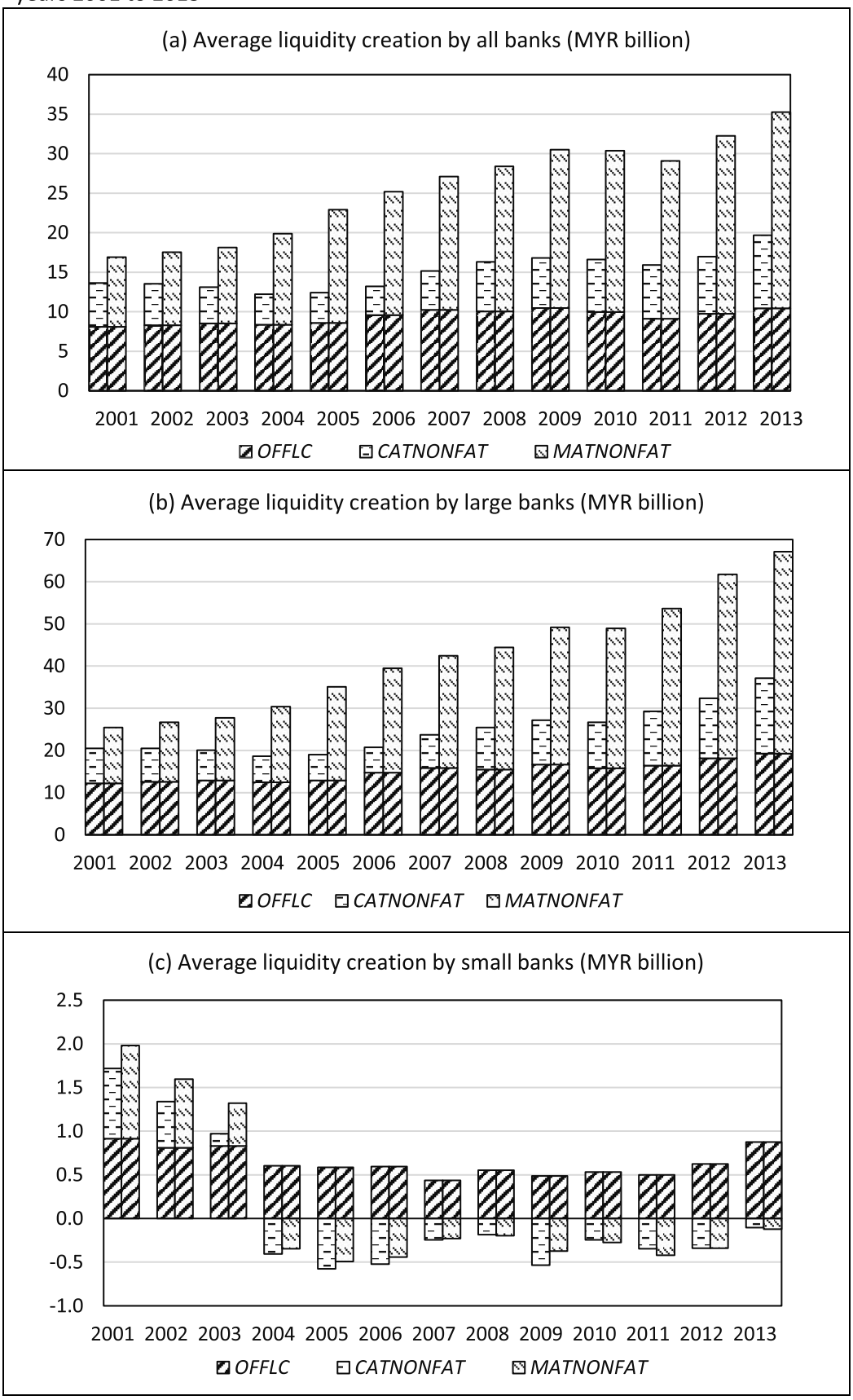
Liquidity creation (*LC*) measure		2001	2003	2005	2007	2009	2011	2013	*LC* as a proportion of total asset
		MYR bn (by TA)	MYR bn (by TA)	MYR bn (by TA)	MYR bn (by TA)	MYR bn (by TA)	MYR bn (by TA)	MYR bn (by TA)	
CATFAT (preferred)	All banks	13.7	13.1	12.4	15.1	16.8	15.9	19.7	
		(0.32)	(0.22)	(0.16)	(0.19)	(0.18)	(0.15)	(0.21)	
	Large banks	20.5	20.0	19.0	23.7	27.2	29.3	37.1	
		(0.37)	(0.31)	(0.26)	(0.28)	(0.26)	(0.26)	(0.29)	
	Small banks	1.72	0.97	0.010	0.19	-0.045	0.15	0.77	
		(0.23)	(0.058)	(-0.023)	(0.034)	(0.052)	(0.009)	(0.12)	
CATNONFAT	All banks	5.56	4.59	3.81	4.90	6.32	6.80	9.24	
		(0.09)	(0.017)	(-0.028)	(0.023)	(0.019)	(0.007)	(0.050)	
	Large banks	8.28	7.13	6.14	7.84	10.5	12.9	17.9	
		(0.13)	(0.095)	(0.066)	(0.079)	(0.083)	(0.10)	(0.13)	
	Small banks	0.80	0.14	-0.58	-0.24	-0.53	-0.35	-0.10	
		(0.034)	(-0.12)	(-0.20)	(-0.075)	(-0.084)	(-0.10)	(-0.035)	
MATFAT	All banks	16.9	18.1	22.9	27.1	30.5	29.1	35.3	
		(0.40)	(0.33)	(0.32)	(0.33)	(0.33)	(0.26)	(0.33)	
	Large banks	25.4	27.7	35.1	42.5	49.2	53.6	67.1	
		(0.48)	(0.46)	(0.48)	(0.49)	(0.50)	(0.50)	(0.54)	
	Small banks	1.98	1.32	0.093	0.21	0.11	0.079	0.75	
		(0.27)	(0.097)	(0.004)	(0.050)	(0.061)	-0.011	(0.11)	

MATNONFAT	All banks	8.82	9.60	14.3	16.9	20.0	20.0	24.8
		(0.18)	(0.13)	(0.13)	(0.17)	(0.17)	(0.13)	(0.17)
	Large banks	13.3	14.8	22.2	26.6	32.6	37.2	47.8
		(0.24)	(0.24)	(0.29)	(0.30)	(0.32)	(0.34)	(0.37)
	Small banks	1.07	0.49	-0.49	-0.23	-0.37	-0.42	-0.12
		(0.069)	(-0.08)	(-0.18)	(-0.06)	(-0.08)	(-0.12)	(-0.045)



Note: All variables are defined in Table 5.1.
Source: Author's calculations

Figure 5.1 Average bank liquidity creation based on- and off-balance sheet components over the years 2001 to 2013



Source: Author's calculations

Table 5.3 Characteristics of large banks versus small banks

Variable	Mean for large banks (>MYR20bn total assets)	Mean for small banks (<MYR20bn total assets)	Absolute *t*-statistic
CATFAT_TA	0.29	0.072	9.60***
CATNONFAT_TA	0.093	-0.081	10.1***
MATFAT_TA	0.49	0.080	19.4***
MATNONFAT_TA	0.30	-0.073	21.4***
OFFLC_TA	0.19	0.15	3.83***
LERNER	0.39	0.12	12.2***
LERNER1	0.36	0.098	11.5***
LOANRATE	0.055	0.048	3.21***
w1	0.024	0.025	0.56
TA	84.8	4.76	12.1***
EQR	0.079	0.20	14.1***
ZSCORE	25.6	35.7	4.54***
CREDIT_RISK	0.64	0.58	3.29***
GLCOWN	0.16	0.003	8.06***
MA	0.19	0.00	5.18***
Observations	179	115	

Note: All variables are defined in Table 5.1, except for *TA* which is defined as bank's total assets in real MYR 2013 billion and *LOANRATE* which is defined as the ratio of interest income on loans to gross loans.

*** denotes 1% significance level in two-tailed *t*-tests

Source: Author's calculations

A main objective of this study is to compare the relationship between bank competition and liquidity creation between small banks and large banks, hence, it may also be important to shed some light on the characteristic differences of these banks. The means of bank-specific variables are compared using the simple two-tailed *t*-tests (see Table 5.3). Based on our benchmark of bank size (MYR 20 billion of total assets), a total of 179 bank observations in our sample fall into the large bank sample, while 115 bank observations are in the small bank sample. Table 5.3 shows that large banks create substantially more liquidity for the economy and enjoy significantly higher market power (*LERNER* and *LERNER1*) than small banks. Large banks also tend to set higher interest rates on loans (*LOANRATE*) than small banks by about 0.7%, implying that small banks compete more aggressively in terms of loan pricing. In terms of deposit pricing (*w1*), large banks do not behave differently from small banks, which suggests that prices of deposits are relatively competitive and uniform across banks.

Besides, the average total assets of large banks amount to MYR 84.8 billion in real 2013 MYR, which is about 17 times larger than those of small banks. The significant mean differences in *EQR*, *ZSCORE* and *CREDIT_RISK* between large and small banks also suggest that small banks are more financially solvent and resilient and generally hold less risky asset portfolios compared to large banks, perhaps

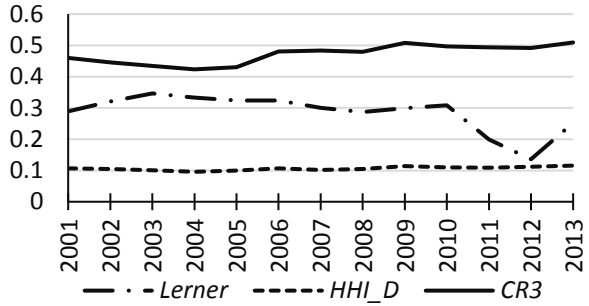
because small banks are not perceived to be too big to fail. They are less likely to be bailed out in case of bank failures. Besides, large banks have a greater proportion of shares held by Malaysian government-linked companies and agencies, as indicated by *GLCOWN*. None of the small banks in our sample was involved in merger and acquisition activities during the sample period.

Table 5.4 Summary statistics on bank competition and stock market liquidity over the years 2001 to 2013

Panel A: Bank competition

Bank market power measure	2001	2003	2005	2007	2009	2011	2013
LERNER	0.29	0.35	0.32	0.30	0.30	0.20	0.25
HHI_D	0.11	0.10	0.10	0.10	0.11	0.11	0.12
CR3	0.46	0.43	0.43	0.48	0.51	0.49	0.51

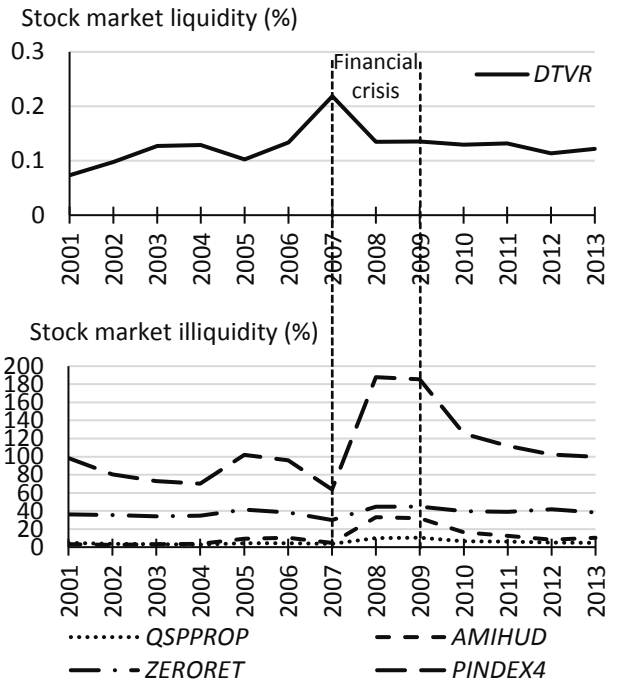
Bank market power, 2001-2013



Panel B: Stock market liquidity

Stock market liquidity measure	2001	2003	2005	2007	2009	2011	2013
DTVR	0.07	0.13	0.10	0.22	0.14	0.13	0.12
QSPPROP	4.70	3.36	4.17	3.46	10.4	5.95	4.54
AMIHUD	3.45	3.27	9.33	4.70	32.0	12.4	10.2
ZERORET	36.1	34.0	41.4	29.9	44.8	39.0	38.4
PINDEX4	98.5	73.0	102	63.7	185	112	100

Stock market liquidity, 2001-2013



Note: All variables are defined in Table 5.1.

Source: Author's calculations

Table 5.4 shows the evolution of bank market competition and stock market liquidity in Malaysia over the sample period in Panel A and Panel B, respectively. Panel A of Table 5.4 shows that the market concentration measures (*HHI_D* and *CR3*) and the average market power (*LERNER*) of banks exhibit contradictory trends of bank market competition. The average *LERNER* of banks has been weakening since the year 2004 and reached particularly low levels from the year 2010. The decreasing *LERNER* over the years can be translated as the intensifying level of competition encountered by commercial banks, which can be partly attributable to the pro-competition initiatives implemented under the FSMP, including the issuance of new Islamic banking licences, relaxation of bank branching restrictions and introduction of new foreign banks (BNM, 2001). Given the *LERNER* index of the banking industry falls within zero (perfect competition) to one (pure monopoly) and is closer to zero, the *LERNER* index suggests the market structure of monopolistic competition for commercial banks in Malaysia, which is consistent with the findings of Abdul-Majid and Sufian (2006) based on Panzar and Rosse's (1987) H-statistic. On the flip side, both *HHI_D* and *CR3* show that the bank market concentration level has increased, although marginally over the years. *HHI_D* suggests that the deposit market of commercial banks is competitive as the average *HHI_D* (1,100 points if expressed in percentage) falls in the region of low market concentration (below 1,500 points) classified by the United States Department of Justice (2015). Nevertheless, *CR3* shows that the bank market in Malaysia is highly concentrated as the total market share of the three largest banks marginally increased by 5 percent from 46 percent to 51 percent during the sample period. The increase does not necessarily suggest a decrease in bank competition as it merely reflects market structural adjustments caused by three consolidation events in the industry. These results based on *LERNER*, *HHI_D* and *CR3* unveil an interesting phenomenon about the Malaysian bank market competition. That is, the playing field for commercial banks has been levelled since the year 2001, despite the bank market being increasingly dominated by a few large banks. This highlights the marginal usefulness of bank market structural measure in measuring competition in today's financial environment.

Panel B of Table 5.4 demonstrates that the stock market in Malaysia did not show any evident and consistent improvement of liquidity over the years 2001 to 2013, despite undergoing capital market reform since 2001. The market liquidity was heavily shattered by the 2007-2009 global financial crisis, as indicated by all four stock market illiquidity measures (*QSPPROP*, *AMIHUD*, *ZERORET* and *PINDEX4*) which reached their peaks during the crisis. The average daily turnover ratio (*DTVR*), on the other hand, was at high during the crisis, which could send a wrong message about the market liquidity if one solely looks at the market turnover ratio. All measures have exhibited similar fluctuating patterns of stock market liquidity throughout the years, except for *DTVR* that did not

move in a similar trend with other measures especially since the onset of the financial crisis. The correlation analysis shown in Table 5.5 confirms that *QSPPROP*, *AMIHUD*, *ZERORET* and *PINDEX4* are good alternative stock market illiquidity measures for each other as their pairwise correlation coefficients are at least as high as 0.77. On the contrary, *DTVR* has relatively lower correlations with other stock market illiquidity measures. *DTVR* is significantly correlated only with *ZERORET* - another stock market trading frequency measure - and with the composite stock market illiquidity index (*PINDEX4*).

Table 5.5 Correlation between stock market liquidity variables

	QSPPROP	*AMIHUD*	*DTVR*	*ZERORET*	*PINDEX4*
QSPPROP	1.00				
AMIHUD	0.97***	1.00			
DTVR	-0.029	0.071	1.00		
ZERORET	0.77***	0.77***	-0.43***	1.00	
PINDEX4	0.97***	0.96***	-0.15***	0.85***	1.00

Note: *** denotes significance at one percent level.
Source: Author's calculations

5.3 Baseline results

This section presents the regression results for research objectives one to three: (i) compare the relationship between bank competition and liquidity creation of small banks in relation to that of large banks in Malaysia, (ii) examine the dominant effect of bank competition on liquidity creation in the Malaysian commercial banking industry, and (iii) examine the relationship between stock market liquidity and bank liquidity creation in Malaysia. All regression models are statistically significant at the one percent level.

5.3.1 Research objective one

We begin with the first research objective by reporting the regression results of the relationship between bank competition and liquidity creation separately for the small bank sample in Panel A of Table 5.6 and for the large bank sample in Panel B of Table 5.6. In both Panel A and Panel B, the regression models based on the four bank liquidity creation measures, including *CATFAT_TA* (preferred measure), *CATNONFAT_TA*, *MATFAT_TA* and *MATNONFAT_TA*, and the off-balance sheet liquidity creation component (*OFFLC_TA*) are estimated and reported in both Panels A and B. Panel A of Table 5.6 demonstrates that, for small banks, the relationship between bank competition and bank liquidity creation is generally negative, as indicated by the positive coefficients on *LERNER* across all the five models reported in the columns. For our preferred liquidity creation measure, *CATFAT_TA*, the magnitude of the coefficient on *LERNER* is 0.23, which means that for every one

percent decrease in bank market power, small banks decrease their liquidity creation by 0.23 percent, *ceteris paribus*. The effect of *LERNER* on on-balance sheet liquidity creation, *CATNONFAT_TA*, for small banks is 0.14 and significant at the one percent significance level. Besides, based on the less stringent "maturity" specification of liquidity creation measures, the result shows a negative relationship between bank competion and total liquidity creation of small banks as *LERNER* is positively related with *MATFAT_TA* and significant at the five percent level, while the impact of bank competition on *MATNONFAT_TA* is insignificant. The results further show that small banks are likely to create less liquidity off their balance sheets when facing higher competition, as indicated by the *LERNER* coefficient of 0.091 which is significant at the five percent level in the *OFFLC_TA* model. Combining these findings leads to a conclusion that bank competition impacts the liquidity creation activities of small banks adversely both on the balance sheet and off the balance sheet. A "fragility channel" effect is, thus, observed for small banks.

As opposed to the "fragility channel" effect of *LERNER* reported for small banks, the results reported in Panel B in Table 5.6 indicate a weak "price channel" effect for large banks. For the "category" specification of liquidity creation measures, the effect of *LERNER* on *CATFAT_TA* is negative and insignificant, while the effect of *LERNER* on *CATNONFAT_TA* is significantly negative at the ten percent significance level. It is also found that the *OFFLC_TA* coefficient is negative but insignificant for large banks. These findings imply that large banks tend to cut down their liquidity creation, particularly through on-balance sheet activities when they possess greater market power or encounter lower bank competition. The insignificant coefficients on *LERNER* for "maturity" specification of liquidity creation measures, *MATFAT_TA* and *MATNONFAT_TA*, do not change our conclusion that the "price channel" effect observed for large banks is weak.

Table 5.6 Effect of bank competition on bank liquidity creation for small banks versus large banks

Panel A: Regression results for small banks (<MYR20 billion total assets)[a]

Variable	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER	0.23	0.14	0.15	0.063	0.091
	(5.59)***	(4.00)***	(2.88)**	(1.34)	(2.36)**
PINDEX4[b]	-0.002	-0.001	-0.001	-0.001	-0.001
	(-1.82)*	(-1.61)	(-1.42)	(-1.26)	(-1.31)
lnTA	-0.14	-0.011	-0.14	-0.006	-0.13
	(-2.02)*	(-0.19)	(-1.96)*	(-0.12)	(-3.30)***
EQR	-0.76	-0.78	-1.00	-1.02	0.015
	(-1.63)	(-1.65)	(-3.01)**	(-3.41)***	(0.08)
GLCOWN	3.74	2.20	4.32	2.77	1.55
	(4.19)***	(1.97)*	(5.33)***	(2.66)**	(2.82)**
ZSCORE	-0.004	-0.001	-0.003	-0.0004	-0.003
	(-1.33)	(-0.43)	(-1.24)	(-0.19)	(-1.82)*
CREDIT_RISK	0.46	0.27	0.40	0.21	0.19
	(3.46)***	(2.60)**	(3.50)***	(2.53)**	(3.25)***
IBSDUMMY	-0.24	-0.17	-0.18	-0.12	-0.065
	(-3.63)***	(-3.68)***	(-2.44)**	(-2.28)**	(-1.86)*
HHI_D	9.61	7.79	6.81	4.99	1.82
	(1.78)*	(1.67)	(1.25)	(1.11)	(0.67)
SCAPRATIO	-0.16	-0.12	-0.11	-0.076	-0.036
	(-1.53)	(-1.57)	(-0.94)	(-0.89)	(-0.75)
MP	1.65	1.99	3.61	3.96	-0.35
	(0.71)	(0.81)	(1.33)	(1.33)	(-0.20)
GDPRATE	-1.14	-0.76	-1.53	-1.15	-0.39
	(-2.43)**	(-2.06)*	(-2.88)**	(-1.92)*	(-1.47)
CRISISDUMMY	-0.013	0.013	-0.020	0.006	-0.026
	(-0.30)	(0.56)	(-0.51)	(0.36)	(-0.79)
Constant	0.65	-0.52	0.83	-0.34	1.18
	(0.76)	(-0.76)	(1.07)	(-0.52)	(2.89)**
Observations	115	115	115	115	115
R^2	0.49	0.47	0.47	0.45	0.37

Panel B: Regression results for large banks (>MYR20 billion total assets)

Variable	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER	-0.31	-0.24	0.015	0.094	-0.079
	(-1.63)	(-1.91)*	(0.07)	(0.39)	(-0.52)
PINDEX4[b]	-0.001	-0.001	-0.0005	-0.0005	-0.00004
	(-3.26)***	(-4.43)***	(-1.92)*	(-2.12)*	(-0.23)
lnTA	-0.13	-0.039	-0.032	0.056	-0.088
	(-2.27)**	(-1.55)	(-0.75)	(1.66)	(-2.01)*
EQR	-2.53	-1.13	-0.61	0.80	-1.40
	(-1.55)	(-1.34)	(-0.43)	(0.51)	(-1.16)
GLCOWN	-0.035	-0.071	0.11	0.077	0.036
	(-0.54)	(-3.10)***	(2.29)**	(0.86)	(0.55)
ZSCORE	0.002	-0.001	-0.002	-0.004	0.002
	(0.41)	(-0.28)	(-0.40)	(-1.05)	(0.65)
CREDIT_RISK	0.28	0.082	0.26	0.067	0.19
	(1.99)*	(1.23)	(1.90)*	(1.02)	(2.36)**
MA	-0.043	-0.021	0.004	0.026	-0.022
	(-1.65)	(-1.29)	(0.21)	(1.53)	(-1.27)
IBSDUMMY	-0.029	-0.020	-0.036	-0.027	-0.009
	(-1.17)	(-1.35)	(-1.57)	(-1.11)	(-0.43)
HHI_D	3.90	4.01	3.29	3.41	-0.11
	(2.17)**	(4.57)***	(2.09)*	(2.27)**	(-0.08)
SCAPRATIO	-0.080	-0.092	-0.069	-0.080	0.012
	(-1.79)*	(-2.99)***	(-1.26)	(-2.08)*	(0.54)
MP	-1.59	-2.58	-2.44	-3.43	0.99
	(-0.66)	(-2.34)**	(-1.19)	(-3.75)***	(0.61)
GDPRATE	-0.14	0.037	0.080	0.26	-0.17
	(-0.47)	(0.20)	(0.27)	(0.98)	(-0.84)
CRISISDUMM	-0.008	-0.007	0.0003	0.001	-0.001
Y	(-0.41)	(-0.56)	(0.02)	(0.06)	(-0.07)
Constant	1.68	0.57	0.65	-0.46	1.10
	(2.51)**	(1.86)	(1.31)	(-1.18)	(2.20)**
Observations	179	179	179	179	179
R^2	0.41	0.36	0.32	0.44	0.41

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

[a] *MA* is omitted from the regression models for small banks because none of the small banks in our sample was involved in merger and acquisition activities during the sample period.

[b] *PINDEX4* is used to proxy for aggregate stock market illiquidity because it is a composite index of *QSPPROP*, *AMIHUD*, inverse *DTVR* and *ZERORET*.

All variables are defined in Table 5.1.

Source: Author's calculations

5.3.2 Research objectives two and three

The second and third research objectives of this study are to examine the dominant relationship between bank competition and liquidity creation in the Malaysian commercial banking industry, and the relationship between stock market liquidity and bank liquidity creation in Malaysia. We examine these research objectives simultaneously in a model because they both employ the full sample banks. In Table 5.7, five panels are created for our four bank liquidity creation measures, namely *CATFAT_TA* (preferred measure), *CATNONFAT_TA*, *MATFAT_TA* and *MATNONFAT_TA*, and the off-balance sheet liquidity creation component (*OFFLC_TA*). Since we have five alternative measures of stock market liquidity, five regression models are analysed and reported in the columns (1) to (5) in each panel, with each column representing a model using the specific stock market liquidity measure.

The results in Panel A of Table 5.7 indicate a positive and significant relationship between *LERNER* and *CATFAT_TA* collectively for all commercial banks, supporting the "fragility channel" view that higher bank competition is associated with lower liquidity being created by banks. The magnitude of the coefficient on *LERNER* ranges from 0.16 to 0.18 across all the five models, which implies that, on average, banks that enjoy a one percent higher market power create 0.16 to 0.18 percent more aggregate liquidity for the economy, *ceteris paribus*. The significant and positive effects of *LERNER* are also evident for on-balance sheet liquidity creation (*CATNONFAT_TA*) in Panel B and for off-balance sheet liquidity creation (*OFFLC_TA*) in Panel E of Table 5.7, with the positive effect of *LERNER* stronger in the earlier case, that is, the *LERNER* coefficient ranges from 0.090 to 0.10 for *CATNONFAT_TA* as compared to 0.069 to 0.073 for *OFFLC_TA*. With regards to bank liquidity creation based on the "maturity" specification, it is found that the magnitude of the *LERNER* coefficient drops slightly for *MATFAT_TA* in Panel C compared to *CATFAT_TA* in Panel A. The *LERNER* coefficient for *MATFAT_TA* ranges from 0.12 to 0.13 and is highly significant. However, the *LERNER* coefficient for *MATNONFAT_TA*, which ranges from 0.052 to 0.061, is insignificant, as indicated in Panel D. The overall findings lead to a conclusion that, on average, Malaysian commercial banks, when facing increased competition, tend to create less liquidity both on and off their balance sheets and thus less total liquidity creation. The "fragility channel" effect of bank competition dominates the Malaysian commercial banking industry.

As for the third research objective, *QSPPROP*, *AMIHUD* and *ZERORET* show negative coefficients in *CATFAT_TA* and *CATNONFAT_TA* models in Panels A and B of Table 5.7, respectively. Since *QSPPROP*, *AMIHUD* and *ZERORET* are inverse measures of stock market liquidity, the negative coefficients on these measures suggest that, on average, an increase in aggregate stock market liquidity enhances

on-balance sheet liquidity creation and total liquidity creation by individual commercial banks. The stock market liquidity measure, *DTVR*, on the other hand, shows an inverse relationship with bank liquidity creation, which this study argues to be doubtful because stock market turnover ratio has been found to be positively correlated to price volatility and has been widely criticised for not reflecting changes in the transaction costs on the market (Fleming, 2003; Karpoff, 1987; Lesmond, 2005; Rouetbi & Mamoghli, 2014). Nevertheless, based on the aggregate stock market illiquidity index score (*PINDEX4*), the estimated coefficient on *PINDEX4* in *CATFAT_TA* and *CATNONFAT_TA* models is negative and highly significant at the one percent level, confirming that, on average, an increase in stock market liquidity boosts liquidity creation by individual commercial banks in Malaysia. In addition, based on the regression results for both *MATFAT_TA* and *MATNONFAT_TA* in Panels C and D, the coefficients on stock market illiquidity measures (*QSPPROP*, *AMIHUD*, *ZERORET* and *PINDEX4*) are also negative and significant except for *ZERORET*. The results reaffirm a negative effect of stock market illiquidity on bank liquidity creation. Panel E of Table 5.7 indicates that stock market illiquidity generally does not have a significant relationship with off-balance sheet liquidity creation, *OFFLC_TA*, although the sign is negative. Only *QSPPROP* appears to be negatively related to *OFFLC_TA* at the five percent significance level, which suggests that an increase in stock market liquidity, measured by lower transaction cost on the stock market, is associated with a higher off-balance sheet liquidity creation of Malaysian commercial banks.

Table 5.7 Effect of bank competition and stock market liquidity on bank liquidity creation

Panel A: Regression results based on *CATFAT_TA* (preferred)

Variable	(1)	(2)	(3)	(4)	(5)
LERNER	0.17	0.18	0.16	0.16	0.17
	(5.25)***	(5.58)***	(4.73)***	(5.00)***	(5.33)***
SLIQUIDITY					
QSPPROP	-0.015				
	(-2.91)***				
AMIHUD		-0.004			
		(-2.79)***			
DTVR			-1.15		
			(-2.28)**		
ZERORET				-0.009	
				(-2.43)**	
PINDEX4					-0.001
					(-2.94)***
lnTA	-0.14	-0.14	-0.13	-0.13	-0.14
	(-4.10)***	(-3.85)***	(-3.47)***	(-3.72)***	(-4.04)***
EQR	-1.16	-1.08	-1.16	-1.05	-1.12
	(-2.57)**	(-2.30)**	(-2.62)**	(-2.16)**	(-2.44)**
GLCOWN	-0.055	-0.054	-0.041	-0.066	-0.053
	(-0.53)	(-0.53)	(-0.41)	(-0.65)	(-0.50)
ZSCORE	-0.001	-0.002	-0.001	-0.002	-0.001
	(-0.47)	(-0.66)	(-0.39)	(-0.66)	(-0.54)
CREDIT_RISK	0.36	0.36	0.36	0.36	0.36
	(3.82)***	(3.93)***	(3.93)***	(3.93)***	(3.85)***
MA	-0.044	-0.033	-0.046	-0.027	-0.040
	(-2.11)**	(-1.48)	(-2.24)**	(-1.18)	(-1.92)*
IBSDUMMY	-0.072	-0.073	-0.073	-0.075	-0.073
	(-2.00)*	(-2.04)*	(-2.07)**	(-2.09)**	(-2.03)*
HHI_D	5.27	4.94	3.24	5.07	4.99
	(1.98)*	(1.89)*	(1.38)	(1.89)*	(1.91)*
SCAPRATIO	-0.084	-0.10	0.13	-0.15	-0.11
	(-2.61)**	(-2.38)**	(2.14)**	(-2.20)**	(-2.60)**
MP	1.23	0.44	4.75	-0.12	0.89
	(0.78)	(0.26)	(2.50)**	(-0.06)	(0.51)
GDPRATE	-0.44	-0.36	0.32	-0.42	-0.53
	(-1.37)	(-1.08)	(0.85)	(-1.27)	(-1.61)
CRISISDUMMY	0.003	0.011	0.062	-0.049	-0.009
	(0.13)	(0.50)	(1.61)	(-2.56)**	(-0.44)
Constant	1.18	1.20	0.84	1.53	1.26
	(2.78)***	(2.75)**	(1.77)*	(3.33)***	(2.92)***
Observations	294	294	294	294	294
R^2	0.41	0.42	0.42	0.42	0.42

Panel B: Regression results based on *CATNONFAT_TA*

Variable	(1)	(2)	(3)	(4)	(5)
LERNER	0.095	0.10	0.090	0.092	0.098
	(2.51)**	(2.67)**	(2.31)**	(2.50)**	(2.54)**
SLIQUIDITY					
QSPPROP	-0.007				
	(-1.84)*				
AMIHUD		-0.003			
		(-2.71)**			
DTVR			-0.77		
			(-1.89)*		
ZERORET				-0.009	
				(-2.88)***	
PINDEX4					-0.0008
					(-3.40)***
lnTA	-0.054	-0.053	-0.046	-0.046	-0.053
	(-1.41)	(-1.33)	(-1.15)	(-1.14)	(-1.40)
EQR	-1.11	-1.04	-1.11	-1.00	-1.08
	(-2.82)***	(-2.60)**	(-2.86)***	(-2.42)**	(-2.71)**
GLCOWN	-0.11	-0.11	-0.10	-0.12	-0.11
	(-3.56)***	(-3.73)***	(-3.58)***	(-4.01)***	(-3.50)***
ZSCORE	0.0001	-0.0004	0.0002	-0.0006	-0.0002
	(0.03)	(-0.17)	(0.09)	(-0.27)	(-0.08)
CREDIT_RISK	0.17	0.16	0.17	0.16	0.16
	(2.24)**	(2.28)**	(2.31)**	(2.29)**	(2.24)**
MA	-0.032	-0.021	-0.032	-0.012	-0.026
	(-2.22)**	(-1.42)	(-2.37)**	(-0.75)	(-1.81)*
IBSDUMMY	-0.047	-0.049	-0.049	-0.051	-0.049
	(-2.04)*	(-2.08)**	(-2.11)**	(-2.14)**	(-2.09)**
HHI_D	4.88	5.07	3.81	5.44	5.19
	(2.58)**	(2.74)**	(2.31)**	(2.93)***	(2.87)***
SCAPRATIO	-0.045	-0.086	0.078	-0.15	-0.10
	(-1.65)	(-2.55)**	(1.46)	(-2.94)***	(-3.00)***
MP	1.10	-0.25	2.96	-1.49	-0.10
	(0.72)	(-0.20)	(1.86)*	(-1.02)	(-0.07)
GDPRATE	-0.11	-0.088	0.37	-0.16	-0.24
	(-0.48)	(-0.35)	(1.33)	(-0.62)	(-0.94)
CRISISDUMMY	0.005	0.018	0.050	-0.033	0.004
	(0.38)	(1.19)	(1.54)	(-2.79)***	(0.35)
Constant	0.15	0.22	-0.036	0.59	0.29
	(0.37)	(0.55)	(-0.08)	(1.43)	(0.69)
Observations	294	294	294	294	294
R^2	0.37	0.38	0.38	0.40	0.38

Panel C: Regression results based on *MATFAT_TA*

Variable	(1)	(2)	(3)	(4)	(5)
LERNER	0.13	0.13	0.12	0.12	0.13
	(2.90)***	(3.11)***	(2.66)**	(2.72)**	(2.96)***
SLIQUIDITY					
QSPPROP	-0.015				
	(-2.60)**				
AMIHUD		-0.003			
		(-1.93)*			
DTVR			-1.03		
			(-2.10)**		
ZERORET				-0.006	
				(-1.34)	
PINDEX4					-0.0007
					(-1.94)*
lnTA	-0.071	-0.066	-0.057	-0.062	-0.066
	(-2.03)*	(-1.88)*	(-1.56)	(-1.74)*	(-1.92)*
EQR	-1.06	-1.00	-1.06	-0.99	-1.03
	(-2.74)**	(-2.43)**	(-2.79)***	(-2.34)**	(-2.59)**
GLCOWN	0.10	0.10	0.12	0.096	0.10
	(2.19)**	(2.13)**	(2.25)**	(2.00)*	(2.20)**
ZSCORE	-0.0005	-0.0008	-0.0002	-0.0008	-0.0006
	(-0.20)	(-0.35)	(-0.10)	(-0.32)	(-0.25)
CREDIT_RISK	0.28	0.28	0.28	0.28	0.28
	(3.62)***	(3.71)***	(3.75)***	(3.70)***	(3.64)***
MA	0.003	0.010	0.0004	0.010	0.004
	(0.18)	(0.58)	(0.02)	(0.55)	(0.24)
IBSDUMMY	-0.090	-0.091	-0.091	-0.091	-0.090
	(-2.67)**	(-2.69)**	(-2.72)**	(-2.71)**	(-2.69)**
HHI_D	3.91	3.28	1.92	3.18	3.29
	(1.53)	(1.32)	(0.90)	(1.25)	(1.33)
SCAPRATIO	-0.093	-0.081	0.11	-0.093	-0.086
	(-2.31)**	(-1.80)*	(1.79)*	(-1.28)	(-1.77)*
MP	-0.26	-0.22	3.17	-0.079	0.17
	(-0.14)	(-0.13)	(1.52)	(-0.04)	(0.09)
GDPRATE	-0.48	-0.38	0.22	-0.41	-0.50
	(-1.49)	(-1.14)	(0.63)	(-1.18)	(-1.46)
CRISISDUMMY	0.005	0.005	0.056	-0.036	-0.01
	(0.27)	(0.27)	(1.54)	(-1.68)	(-0.59)
Constant	0.82	0.78	0.49	0.96	0.82
	(1.92)*	(1.84)*	(1.02)	(2.15)**	(1.95)*
Observations	294	294	294	294	294
R^2	0.35	0.35	0.35	0.35	0.34

Panel D: Regression results based on *MATNONFAT_TA*

Variable	(1)	(2)	(3)	(4)	(5)
LERNER	0.056	0.061	0.052	0.054	0.058
	(1.23)	(1.35)	(1.11)	(1.17)	(1.27)
SLIQUIDITY					
QSPPROP	-0.007				
	(-1.74)*				
AMIHUD		-0.002			
		(-1.86)*			
DTVR			-0.66		
			(-1.55)		
ZERORET				-0.005	
				(-1.60)	
PINDEX4					-0.0006
					(-2.18)**
lnTA	0.017	0.019	0.025	0.023	0.019
	(0.53)	(0.57)	(0.72)	(0.68)	(0.59)
EQR	-1.01	-0.96	-1.01	-0.94	-0.98
	(-3.05)***	(-2.79)***	(-3.08)***	(-2.66)**	(-2.93)***
GLCOWN	0.045	0.045	0.053	0.038	0.046
	(0.41)	(0.40)	(0.46)	(0.34)	(0.42)
ZSCORE	0.0009	0.0006	0.001	0.0005	0.0007
	(0.46)	(0.29)	(0.54)	(0.24)	(0.38)
CREDIT_RISK	0.086	0.086	0.087	0.086	0.085
	(1.50)	(1.51)	(1.56)	(1.51)	(1.49)
MA	0.0148	0.021	0.014	0.026	0.018
	(0.93)	(1.31)	(0.93)	(1.44)	(1.13)
IBSDUMMY	-0.066	-0.066	-0.066	-0.068	-0.066
	(-2.45)**	(-2.46)**	(-2.49)**	(-2.48)**	(-2.47)**
HHI_D	3.52	3.41	2.50	3.55	3.49
	(1.81)*	(1.81)*	(1.44)	(1.88)*	(1.88)*
SCAPRATIO	-0.055	-0.067	0.057	-0.10	-0.078
	(-1.77)*	(-2.03)*	(1.05)	(-1.77)*	(-2.11)**
MP	-0.39	-0.92	1.38	-1.44	-0.81
	(-0.20)	(-0.63)	(0.74)	(-1.05)	(-0.48)
GDPRATE	-0.15	-0.11	0.28	-0.15	-0.21
	(-0.45)	(-0.32)	(0.96)	(-0.42)	(-0.59)
CRISISDUMMY	0.007	0.012	0.044	-0.020	0.003
	(0.60)	(0.90)	(1.34)	(-1.34)	(0.24)
Constant	-0.21	-0.19	-0.38	0.014	-0.15
	(-0.52)	(-0.49)	(-0.89)	(0.04)	(-0.38)
Observations	294	294	294	294	294
R^2	0.36	0.36	0.36	0.37	0.36

Panel E: Regression results based on *OFFLC_TA*

Variable	(1)	(2)	(3)	(4)	(5)
LERNER	0.072	0.073	0.069	0.071	0.072
	(2.43)**	(2.50)**	(2.29)**	(2.36)**	(2.42)**
SLIQUIDITY					
QSPPROP	-0.008				
	(-2.59)**				
AMIHUD		-0.001			
		(-1.46)			
DTVR			-0.37		
			(-2.00)*		
ZERORET				-0.0003	
				(-0.17)	
PINDEX4					-0.0002
					(-1.01)
lnTA	-0.088	-0.085	-0.082	-0.085	-0.085
	(-2.92)***	(-2.86)***	(-2.74)**	(-2.83)***	(-2.83)***
EQR	-0.051	-0.033	-0.053	-0.051	-0.047
	(-0.27)	(-0.17)	(-0.28)	(-0.25)	(-0.24)
GLCOWN	0.057	0.058	0.062	0.058	0.058
	(0.63)	(0.64)	(0.70)	(0.64)	(0.64)
ZSCORE	-0.001	-0.001	-0.001	-0.001	-0.001
	(-1.16)	(-1.20)	(-1.07)	(-1.05)	(-1.12)
CREDIT_RISK	0.19	0.19	0.19	0.192	0.19
	(3.97)***	(4.03)***	(4.00)***	(4.02)***	(4.00)***
MA	-0.012	-0.011	-0.014	-0.015	-0.014
	(-0.81)	(-0.75)	(-0.92)	(-0.93)	(-0.90)
IBSDUMMY	-0.024	-0.024	-0.024	-0.024	-0.024
	(-1.28)	(-1.29)	(-1.31)	(-1.27)	(-1.28)
HHI_D	0.39	-0.13	-0.58	-0.37	-0.20
	(0.27)	(-0.09)	(-0.41)	(-0.24)	(-0.13)
SCAPRATIO	-0.039	-0.014	0.050	0.008	-0.008
	(-1.75)*	(-0.69)	(2.04)*	(0.24)	(-0.39)
MP	0.13	0.69	1.79	1.36	0.99
	(0.14)	(0.74)	(1.80)*	(1.23)	(1.03)
GDPRATE	-0.33	-0.27	-0.054	-0.26	-0.30
	(-2.07)**	(-1.69)	(-0.31)	(-1.68)	(-1.89)*
CRISISDUMMY	-0.002	-0.007	0.012	-0.016	-0.013
	(-0.19)	(-0.56)	(0.93)	(-1.32)	(-1.04)
Constant	1.03	0.97	0.88	0.94	0.97
	(3.41)***	(3.33)***	(2.89)***	(3.32)***	(3.26)***
Observations	294	294	294	294	294
R^2	0.35	0.35	0.35	0.34	0.34

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

All variables are defined in Table 5.1.

Source: Author's calculations

5.4 Additional tests

In this section, we conduct several additional tests to test the three main research objectives of this study and show that the findings support our baseline findings reported in Section 5.3. The additional tests (i) use an alternative dataset to compute bank-level Lerner index; (ii) examine the effect of banking deregulation and liberalisation; (iii) account for the impact of the 2008 financial crisis by excluding observations in the years 2007 to 2009 from the estimations; (iv) use alternative benchmarks to classify sample banks into large banks and small banks; (v) examine the threshold effect of bank competition on liquidity creation; (vi) examine the dynamic effect of bank competition and stock market liquidity on bank liquidity creation; and (vii) include an endogeneity test in the context of instrumental variable estimation.

5.4.1 Using an alternative bank competition measure

Recalling that the *LERNER* index of market power used in the regressions in Section 5.3 is estimated based on a combined dataset of commercial banks and Islamic banks, we now estimate an alternative bank market power measure using a dataset of commercial banks only. The alternative bank market power measure is labelled as *LERNER1*[31]. The purpose of this additional test is to ensure our findings for the first and second research objectives are robust to the use of *LERNER1*. Table 5.8 shows the effect of *LERNER1* on total bank liquidity creation (*CATFAT_TA*) separately for small banks, large banks and the entire bank sample. The *LERNER1* coefficients for the three sets of sample banks are of similar magnitude to the *LERNER* coefficients reported in the main results. The coefficients on *LERNER1* remain positive and significant at the one percent level for small and full sample banks, which are 0.20 and 0.16, respectively. As for large banks, the relationship between *LERNER1* and total bank liquidity creation remains insignificant. Thus, this additional test confirms our baseline regression results for research objectives one and two that the "fragility channel" effect of bank competition occurs among small banks and dominates the Malaysian commercial banking industry.

[31] A paired *t*-test is conducted to compare *LERNER* and *LERNER1* of our sample banks. The result shows that the mean of *LERNER1* (0.26) is lower than *LERNER* (0.28) at the one percent significance level, which implies that excluding Islamic banks from the cost function estimation could result in an underestimation of the market power of commercial banks in the Malaysian dual banking system.

Table 5.8 Effect of bank competition on *CATFAT_TA* based on an alternative bank competition measure

Variable	Small banks	Large banks	All banks
LERNER1	0.22	-0.31	0.16
	(5.58)***	(-1.62)	(5.03)***
PINDEX4[a]	-0.002	-0.001	-0.001
	(-1.81)*	(-3.26)***	(-2.94)***
lnTA	-0.14	-0.13	-0.14
	(-2.00)*	(-2.28)**	(-4.02)***
EQR	-0.76	-2.53	-1.12
	(-1.62)	(-1.55)	(-2.43)**
GLCOWN	3.75	-0.034	-0.053
	(4.22)***	(-0.53)	(-0.50)
ZSCORE	-0.004	0.002	-0.001
	(-1.32)	(0.41)	(-0.54)
CREDIT_RISK	0.46	0.28	0.35
	(3.43)***	(1.99)*	(3.84)***
MA[b]	-	-0.043	-0.040
		(-1.65)	(-1.92)*
IBSDUMMY	-0.24	-0.029	-0.073
	(-3.61)***	(-1.19)	(-2.02)*
HHI_D	9.56	3.91	4.96
	(1.77)	(2.18)**	(1.90)*
SCAPRATIO	-0.16	-0.079	-0.11
	(-1.52)	(-1.79)*	(-2.59)**
MP	1.66	-1.58	0.90
	(0.72)	(-0.65)	(0.52)
GDPRATE	-1.15	-0.13	-0.54
	(-2.45)**	(-0.45)	(-1.63)
CRISISDUMMY	-0.014	-0.008	-0.009
	(-0.32)	(-0.41)	(-0.46)
Constant	0.65	1.66	1.26
	(0.75)	(2.52)**	(2.91)***
Observations	115	179	294
R^2	0.49	0.41	0.41

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.
***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.
[a] *PINDEX4* is used to proxy for aggregate stock market illiquidity because it is a composite index of *QSPPROP*, *AMIHUD*, inverse *DTVR* and *ZERORET*.
[b] *MA* is omitted from the regression models for small banks because none of the small banks in our sample was involved in merger and acquisition activities during the sample period.
All variables are defined in Table 5.1.
Source: Author's calculations

5.4.2 Effect of banking deregulation and liberalisation

While our findings of bank competition offer policy implications for bank-based financial systems, we further evaluate whether regulatory-induced competition in banking affects liquidity creation of banks in Malaysia. This enables us to shed more light on banking deregulation policies in Malaysia. Since our sample period (2001 to 2013) covers the implementation of a series of far-reaching reforms governed by the Financial Sector Masterplan (FSMP) from the period 2001 to 2010, we are able to take into account for the regulatory-induced competition in our regression model. In particular, the year 2004 marks the beginning of Phase two of the FSMP (2004-2005) during which deregulation and liberalisation initiatives that add further competition to the banking industry were implemented, for example, interest rate deregulation, relaxation of bank branching restrictions and issuance of new licenses to foreign and Islamic banks.

Hence, the baseline equation (5) is modified by including a dummy variable that equals one for the banking deregulation and liberalisation initiatives implemented since the year 2004, zero otherwise. The dummy variable is labelled as *COMPOLICY*.

$$LC_{it} = \beta_1 LERNER_{it} + \beta_2 COMPOLICY + \beta_3 X_{it} + a_i + u_{it} \quad (8)$$

In addition, we include an interaction term between *LERNER* and *COMPOLICY* to evaluate the effect of bank competition on bank liquidity creation during the banking deregulation and liberalisation period.

$$LC_{it} = \beta_1 LERNER_{it} + \beta_2 COMPOLICY + \beta_3 LERNER*COMPOLICY + \beta_4 X_{it} + a_i + u_{it} \quad (9)$$

Because the *LERNER*COMPOLICY* interaction term is highly correlated with *LERNER* and *COMPOLICY* competition measures, all these variables are orthogonalised using the Stata command "orthog". For simplicity, we use the terms *LERNER*, *COMPOLICY* and *LERNER*COMPOLICY* instead of orthogonalised *LERNER*, orthogonalised *COMPOLICY* and orthogonalised *LERNER*COMPOLICY* throughout. Equations (8) and (9) are estimated for the small bank, large bank and full bank samples, and the results are reported accordingly in Table 5.9.

Table 5.9 shows for small banks in columns (1) and (2) that the estimated coefficients on *LERNER* are significantly positive at the one percent level, confirming that small banks reduce their total liquidity creation when facing an increase in competition. It is also found that the estimated coefficients on *COMPOLICY* are -0.052 and -0.040 and are significant at the five percent level. The results indicate that banking deregulation and liberalisation initiatives have a negative impact on liquidity creation of small banks in Malaysia, which implies that regulation-induced competition discourages bank liquidity creation. As for large banks, banking deregulation and liberalisation initiatives also exert a

negative impact on bank liquidity creation, but the impact is relatively weaker compared to small banks, as indicated by the estimated negative coefficient on *COMPOLICY* (-0.024) in column (4) which is significant at the ten percent level. When looking at the results for the Malaysian commercial banking industry as a whole in columns (5) and (6) in Table 5.9, it is found that the estimated coefficients on *LERNER* are significantly positive, *COMPOLICY* are significantly negative and the *LERNER*COMPOLICY* interaction term is positively significant at the five percent level. The results suggest that banks respond to higher competition by cutting their total liquidity creation and that banking deregulation and liberalisation initiatives destroy liquidity creation of the industry as well as banks that possess lower market power as a whole. The results also offer important policy implications that the banking deregulation and liberalisation initiaves implemented since the year 2004 do not help to improve liquidity access of the public, in general.

Table 5.9 Effect of banking deregulation and liberalisation on *CATFAT_TA*

Variable	Small banks (1)	Small banks (2)	Large banks (3)	Large banks (4)	All banks (5)	All banks (6)
LERNER	0.053	0.049	-0.069	-0.051	0.039	0.036
	(6.17)***	(4.08)***	(-1.51)	(-1.00)	(5.27)***	(3.86)***
COMPOLICY	-0.052	-0.040	-0.013	-0.024	-0.028	-0.029
	(-3.02)**	(-2.69)**	(-1.39)	(-2.08)*	(-2.81)***	(-3.50)***
*LERNER**		0.020		0.017		0.022
COMPOLICY		(1.61)		(1.53)		(2.68)**
PINDEX4[a]	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.88)	(-0.76)	(-3.32)***	(-3.16)***	(-2.73)**	(-2.35)**
lnTA	-0.12	-0.12	-0.10	-0.099	-0.12	-0.12
	(-1.51)	(-1.43)	(-1.84)*	(-1.69)	(-3.17)***	(-3.15)***
EQR	-0.64	-0.73	-2.32	-2.23	-1.03	-1.19
	(-1.82)*	(-1.74)	(-1.43)	(-1.53)	(-2.30)**	(-2.45)**
GLCOWN	2.18	0.57	-0.032	-0.046	-0.053	-0.085
	(2.60)**	(0.32)	(-0.51)	(-0.82)	(-0.57)	(-1.05)
ZSCORE	-0.005	-0.004	0.001	0.001	-0.002	-0.001
	(-2.11)*	(-1.73)	(0.33)	(0.36)	(-0.74)	(-0.53)
CREDIT_RISK	0.48	0.52	0.27	0.27	0.36	0.41
	(4.43)***	(5.09)***	(1.92)*	(1.93)*	(3.98)***	(4.35)***
MA[b]	-	-	-0.033	-0.032	-0.018	-0.029
			(-1.16)	(-1.16)	(-0.81)	(-1.33)
IBSDUMMY	-0.25	-0.26	-0.033	-0.036	-0.080	-0.077
	(-4.19)***	(-4.41)***	(-1.26)	(-1.49)	(-2.23)**	(-2.12)**
HHI_D	7.13	6.20	3.25	2.98	4.03	3.44
	(1.49)	(1.18)	(1.81)*	(1.59)	(1.64)	(1.39)
SCAPRATIO	-0.028	-0.003	-0.067	-0.065	-0.068	-0.044
	(-0.41)	(-0.05)	(-1.60)	(-1.54)	(-2.10)**	(-1.23)
MP	0.89	0.49	-1.96	-1.85	-0.20	-0.075
	(0.39)	(0.19)	(-0.78)	(-0.73)	(-0.10)	(-0.04)
GDPRATE	-0.25	-0.027	-0.014	0.038	-0.13	0.015
	(-0.59)	(-0.05)	(-0.05)	(0.15)	(-0.45)	(0.05)
CRISISDUMMY	-0.004	-0.002	-0.003	-0.0001	0.0004	0.001
	(-0.09)	(-0.04)	(-0.17)	(-0.01)	(0.02)	(0.04)
Constant	0.46	0.50	1.38	1.31	1.10	1.11
	(0.50)	(0.53)	(2.26)**	(2.12)*	(2.44)**	(2.33)**
Observations	115	115	179	179	294	294
R^2	0.53	0.53	0.42	0.43	0.43	0.46

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

[a] *PINDEX4* is used to proxy for aggregate stock market illiquidity because it is a composite index of *QSPPROP*, *AMIHUD*, inverse *DTVR* and *ZERORET*.

[b] *MA* is omitted from the regression models for small banks because none of the small banks in our sample was involved in merger and acquisition activities during the sample period.

Source: Author's calculations

5.4.3 Removing observations during the 2007-2009 financial crisis year

Since the 2008 financial crisis caused financial market and monetary liquidity squeezes in some Western economies such as the U.S. and Iceland, it is important to perform an additional test that ensures the crisis does not contaminate our main findings. Hence, bank observations in the years 2007 to 2009 are excluded from estimations in the additional test. Table 5.10 shows the results of the additional test. As shown in column (1), the marginal effect of *LERNER* on total liquidity creation (*CATFAT_TA*) by small banks drops slightly from 0.23 in the main estimation to 0.21 in the additional test, but the effect of *LERNER* remains significant at the one percent level, confirming the "fragility channel" effect for small banks. For large banks, bank competition does not have a significant impact on their liquidity creation, as indicated by the insignificant *LERNER* coefficient of -0.14 in column (2). The additional test results for the second and third research objectives are reported in the columns (3) to (7), with each column representing a model using the specific stock market liquidity measure. It is shown that the magnitude of the coefficient on *LERNER* increases slightly and remains highly significant at the one percent level, confirming the "fragility channel" effect in the Malaysian commercial banking industry as a whole. As for the relationship between stock market liquidity and bank liquidity creation, the coefficients on stock market illiquidity measures (*QSPPROP*, *AMIHUD* and *ZERORET*) as well as the coefficient on stock market turnover ratio (*DTVR*) remain significantly negative. The aggregate stock market illiquidity index score (*PINDEX4*), again, confirms that a liquid stock market is positively associated with bank liquidity creation. Thus, we can conclude that our main findings are not influenced by the 2008 global financial crisis.

Table 5.10 Effect of bank competition and stock market liquidity on *CATFAT_TA* during non-crisis years

	Small banks	Large banks	All banks				
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LERNER	0.21	-0.14	0.17	0.18	0.17	0.17	0.17
	(4.58)***	(-0.66)	(4.79)***	(5.07)***	(4.66)***	(4.58)***	(4.87)***
SLIQUIDITY							
QSPPROP			-0.018				
			(-2.37)**				
AMIHUD				-0.009			
				(-3.95)***			
DTVR					-1.35		
					(-2.94)***		
ZERORET						-0.008	
						(-2.15)**	
PINDEX4	-0.002	-0.001					-0.001
	(-1.71)	(-2.25)**					(-3.46)***
lnTA	-0.14	-0.14	-0.15	-0.15	-0.13	-0.13	-0.15
	(-2.11)*	(-1.94)*	(-3.79)***	(-3.89)***	(-3.26)***	(-3.20)***	(-3.90)***
EQR	-0.58	-3.86	-1.21	-1.10	-1.17	-1.11	-1.16
	(-1.59)	(-2.20)**	(-2.52)**	(-2.40)**	(-2.45)**	(-2.21)**	(-2.46)**
GLCOWN	4.96	-0.13	-0.13	-0.11	-0.12	-0.13	-0.12
	(3.26)***	(-0.97)	(-0.66)	(-0.62)	(-0.68)	(-0.73)	(-0.64)
ZSCORE	-0.004	0.005	-0.0009	-0.002	-0.0009	-0.001	-0.001
	(-1.66)	(0.92)	(-0.30)	(-0.62)	(-0.31)	(-0.44)	(-0.41)
CREDIT_RISK	0.47	0.21	0.33	0.32	0.33	0.33	0.33
	(2.04)*	(1.81)*	(3.06)***	(3.11)***	(3.22)***	(3.17)***	(3.06)***
MA[a]	-	-0.061	-0.050	-0.021	-0.050	-0.035	-0.040
		(-1.63)	(-1.96)*	(-0.77)	(-1.92)*	(-1.32)	(-1.58)
IBSDUMMY	-0.28	-0.045	-0.083	-0.090	-0.085	-0.086	-0.086
	(-2.36)**	(-1.86)*	(-1.90)*	(-2.09)**	(-1.96)*	(-1.96)*	(-1.96)*
HHI_D	7.64	3.92	4.46	5.75	1.93	3.89	4.94
	(1.83)*	(1.69)	(1.91)*	(2.37)**	(0.94)	(1.69)	(2.09)**
SCAPRATIO	-0.042	-0.070	-0.020	-0.017	0.19	-0.085	-0.062
	(-0.37)	(-2.11)*	(-0.57)	(-0.43)	(2.59)**	(-1.12)	(-1.47)
MP	-1.47	-2.31	-0.59	-1.44	2.18	-0.78	-1.04
	(-0.33)	(-0.77)	(-0.24)	(-0.57)	(0.92)	(-0.29)	(-0.41)
GDPRATE	-2.54	-0.47	-1.18	-0.58	-0.51	-0.99	-1.18
	(-2.43)**	(-1.33)	(-2.32)**	(-1.44)	(-1.17)	(-2.19)**	(-2.36)**
Constant	0.79	1.88	1.37	1.22	1.14	1.57	1.44
	(1.00)	(2.41)**	(2.99)***	(2.63)**	(2.41)**	(3.16)***	(3.10)***
Observations	91	138	229	229	229	229	229
R^2	0.53	0.48	0.44	0.47	0.46	0.45	0.45

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

[a] *MA* is omitted from the regression models for small banks because because none of the small banks in our sample was involved in merger and acquisition activities during the sample period.

All variables are defined in Table 5.1.

Source: Author's calculations

5.4.4 Using alternative cut-off points for classes of bank size

The fourth additional test is conducted to examine whether our findings on the influence of bank competition on bank liquidity creation by bank size are robust to different benchmarks of classes of bank size. In this additional test, two alternative benchmarks are employed to classify banks into small and large banks, which are the median of banks' total assets (MYR 34.5 billion) and the number of bank branches. In the latter benchmark, we set the cut-off point to be 16 branches to denote bank markets in all 13 states and 3 federal territories in Malaysia, given the consideration that large banks in Malaysia operate in multi-markets throughout the nation through extensive branch networks, while small banks generally operate about three branches concentrating in developed states or federal territories. Since data on bank branches are available from the year 2010 to 2013, we define large banks as banks that operate more than 16 branches at the end-year 2013, and small banks otherwise[32].

The regression results using the median banks' total assets (MYR 34.5 billion) as the benchmark are reported in Table 5.11, while the results using 16 bank branches as the benchmark are reported in Table 5.12. The results in Panel A in both Table 5.11 and Table 5.12 show that the *LERNER* coefficients are significantly positive for nearly all the liquidity creation measures, confirming that small banks create less liquidity when they have lower market power. On the other hand, the additional test results confirm that large banks tend to create more liquidity when they possess lower market power. However, the coefficient on *LERNER* is only significant for regressions based on the "category" specification of liquidity creation measures, as presented in the column for *CATNONFAT_TA* in Panel B of Table 5.11 and in the columns for *CATFAT_TA* and *CATNONFAT_TA* in Panel B of Table 5.12. These additional findings are qualitatively similar to our main findings reported in Section 5.3.1.

[32] The classification of sample banks into large and small banks does not change if the cut-off of 16 branches at the end-year 2010 is used instead.

Table 5.11 Effect of bank competition on bank liquidity creation for small and large banks using median total assets as a cut-off point

Panel A: Regression results for small banks (<MYR34.5 billion total assets)					
Variable	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER	0.20	0.12	0.15	0.069	0.083
	(5.15)***	(3.39)***	(2.92)***	(1.51)	(2.45)**
PINDEX4[a]	-0.001	-0.001	-0.001	-0.001	-0.001
	(-2.17)**	(-1.78)*	(-1.62)	(-1.21)	(-1.92)*
lnTA	-0.13	-0.003	-0.14	-0.006	-0.13
	(-1.65)	(-0.05)	(-1.85)*	(-0.11)	(-3.00)***
EQR	-0.98	-0.92	-0.98	-0.92	-0.065
	(-1.76)*	(-1.90)*	(-2.64)**	(-3.05)***	(-0.38)
GLCOWN	0.42	-0.089	-0.13	-0.64	0.51
	(2.17)**	(-0.50)	(-0.69)	(-3.98)***	(8.59)***
ZSCORE	-0.003	-0.0003	-0.003	-0.001	-0.002
	(-0.84)	(-0.12)	(-1.17)	(-0.34)	(-1.87)*
CREDIT_RISK	0.39	0.23	0.31	0.15	0.16
	(3.16)***	(2.46)**	(3.16)***	(2.11)**	(3.09)***
MA	-0.029	-0.027	0.003	0.006	-0.002
	(-0.50)	(-0.74)	(0.13)	(0.69)	(-0.10)
IBSDUMMY	-0.14	-0.11	-0.18	-0.14	-0.035
	(-2.15)**	(-2.74)**	(-3.33)***	(-4.93)***	(-1.16)
HHI_D	5.82	5.29	5.21	4.68	0.53
	(1.30)	(1.54)	(1.35)	(1.59)	(0.23)
SCAPRATIO	-0.16	-0.11	-0.14	-0.086	-0.050
	(-2.19)**	(-1.81)*	(-1.56)	(-1.23)	(-1.49)
MP	1.06	2.04	0.88	1.87	-0.99
	(0.50)	(1.01)	(0.35)	(0.75)	(-0.73)
GDPRATE	-1.26	-0.87	-1.23	-0.85	-0.39
	(-3.07)***	(-2.90)***	(-2.91)***	(-1.79)*	(-1.71)
CRISISDUMMY	-0.043	-0.010	-0.039	-0.006	-0.033
	(-1.02)	(-0.45)	(-1.07)	(-0.33)	(-1.18)
Constant	1.08	-0.31	1.26	-0.13	1.39
	(1.13)	(-0.46)	(1.55)	(-0.21)	(3.03)***
Observations	147	147	147	147	147
R^2	0.43	0.43	0.42	0.45	0.35

Panel B: Regression results for large banks (>MYR34.5 billion total assets)

Variable	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER	-0.26	-0.27	-0.14	-0.15	0.01
	(-1.63)	(-1.97)*	(-0.69)	(-0.63)	(0.06)
PINDEX4[a]	-0.0004	-0.001	-0.0002	-0.0004	0.0002
	(-2.21)**	(-4.14)***	(-1.02)	(-2.00)*	(1.13)
lnTA	-0.071	-0.017	0.019	0.073	-0.054
	(-1.39)	(-0.68)	(0.36)	(1.75)	(-1.36)
EQR	-0.26	-1.08	-0.78	-1.60	0.82
	(-0.17)	(-1.00)	(-0.49)	(-1.56)	(1.08)
GLCOWN	-0.10	-0.068	0.13	0.16	-0.034
	(-2.02)*	(-1.77)*	(3.53)***	(4.80)***	(-1.21)
ZSCORE	-0.002	0.001	0.0001	0.003	-0.003
	(-0.42)	(0.45)	(0.02)	(1.51)	(-1.06)
CREDIT_RISK	0.60	0.21	0.56	0.18	0.39
	(3.83)***	(1.88)*	(4.44)***	(1.79)*	(6.62)***
MA	-0.035	-0.018	-0.006	0.011	-0.017
	(-1.23)	(-0.82)	(-0.03)	(0.56)	(-0.90)
IBSDUMMY	-0.055	-0.032	-0.032	-0.008	-0.024
	(-2.69)**	(-2.09)*	(-1.32)	(-0.37)	(-1.65)
HHI_D	1.67	2.44	0.74	1.51	-0.77
	(0.97)	(2.99)***	(0.35)	(0.96)	(-0.52)
SCAPRATIO	-0.024	-0.067	-0.002	-0.044	0.043
	(-0.59)	(-2.36)**	(-0.04)	(-1.63)	(2.15)*
MP	-0.64	-2.10	-2.10	-3.56	1.46
	(-0.26)	(-1.72)	(-0.98)	(-2.97)**	(0.94)
GDPRATE	0.29	0.20	0.29	0.20	0.089
	(0.93)	(1.12)	(0.75)	(0.71)	(0.46)
CRISISDUMMY	0.008	-0.0003	-0.0004	-0.008	0.008
	(0.47)	(-0.02)	(-0.03)	(-0.65)	(1.39)
Constant	0.82	0.29	0.035	-0.49	0.52
	(1.37)	(1.00)	(0.06)	(-1.11)	(1.20)
Observations	147	147	147	147	147
R^2	0.57	0.39	0.48	0.49	0.57

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

[a] *PINDEX4* is used to proxy for aggregate stock market illiquidity because it is a composite index of *QSPPROP*, *AMIHUD*, inverse *DTVR* and *ZERORET*.

All variables are defined in Table 5.1.

Source: Author's calculations

Table 5.12 Effect of bank competition on bank liquidity creation for small and large banks using 16 bank branches as a cut-off point

Panel A: Regression results for small banks[a] (<16 branches)

Variable	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER	0.22	0.14	0.16	0.068	0.089
	(5.63)***	(4.06)***	(2.88)**	(1.44)	(2.38)**
PINDEX4[b]	-0.002	-0.001	-0.001	-0.001	-0.001
	(-2.20)**	(-2.02)*	(-1.66)	(-1.48)	(-1.51)
lnTA	-0.14	-0.011	-0.15	-0.017	-0.13
	(-2.03)*	(-0.21)	(-2.09)*	(-0.34)	(-3.39)***
EQR	-0.81	-0.76	-1.21	-1.15	-0.055
	(-1.78)*	(-1.66)	(-2.98)**	(-3.14)***	(-0.33)
ZSCORE	-0.003	-0.001	-0.002	0.001	-0.002
	(-1.36)	(-0.50)	(-0.81)	(0.33)	(-1.63)
CREDIT_RISK	0.42	0.21	0.34	0.14	0.20
	(3.54)***	(2.29)**	(3.26)***	(1.72)	(3.94)***
IBSDUMMY	-0.24	-0.17	-0.19	-0.13	-0.061
	(-3.50)***	(-3.61)***	(-2.42)**	(-2.30)**	(-1.88)*
HHI_D	10.4	8.17	8.33	6.14	2.19
	(2.15)*	(2.01)*	(1.68)	(1.55)	(0.91)
SCAPRATIO	-0.18	-0.14	-0.12	-0.083	-0.035
	(-1.90)*	(-2.03)*	(-1.10)	(-1.09)	(-0.76)
MP	0.50	0.41	2.22	2.12	0.094
	(0.23)	(0.17)	(0.91)	(0.78)	(0.06)
GDPRATE	-0.75	-0.42	-1.04	-0.70	-0.33
	(-1.41)	(-1.00)	(-1.70)	(-1.17)	(-1.53)
CRISISDUMMY	-0.004	0.019	-0.012	0.012	-0.023
	(-0.11)	(0.82)	(-0.34)	(0.63)	(-0.78)
Constant	0.72	-0.45	0.90	-0.27	1.17
	(0.83)	(-0.67)	(1.13)	(-0.41)	(2.86)**
Observations	125	125	125	125	125
R^2	0.48	0.44	0.46	0.43	0.40

Panel B: Regression results for large banks (>16 branches)

Variable	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER	-0.27	-0.25	0.032	0.052	-0.020
	(-1.70)	(-2.29)**	(0.16)	(0.22)	(-0.15)
PINDEX4[b]	-0.001	-0.001	-0.0005	-0.0005	-0.00002
	(-3.10)***	(-4.34)***	(-1.79)*	(-2.04)*	(-0.09)
lnTA	-0.12	-0.073	-0.048	0.0005	-0.048
	(-3.68)***	(-4.12)***	(-1.71)	(0.01)	(-1.56)
EQR	-2.37	-1.61	-0.61	0.15	-0.76
	(-1.57)	(-2.05)*	(-0.42)	(0.11)	(-0.59)
GLCOWN	-0.037	-0.079	0.11	0.070	0.042
	(-0.57)	(-3.18)***	(2.13)*	(0.68)	(0.55)
ZSCORE	0.001	-0.001	-0.003	-0.004	0.001
	(0.17)	(-0.30)	(-0.68)	(-1.19)	(0.29)
CREDIT_RISK	0.28	0.11	0.24	0.067	0.17
	(1.63)	(1.30)	(1.50)	(0.81)	(1.83)*
MA	-0.044	-0.019	0.005	0.030	-0.025
	(-1.65)	(-1.18)	(0.26)	(1.52)	(-1.35)
IBSDUMMY	-0.029	-0.016	0.033	-0.019	-0.013
	(-1.34)	(-1.29)	(-1.68)	(-0.96)	(-0.70)
HHI_D	3.61	5.05	3.34	4.77	-1.43
	(2.26)**	(7.95)***	(2.98)**	(2.85)**	(-1.03)
SCAPRATIO	-0.090	-0.092	-0.076	-0.078	0.002
	(-1.87)*	(-2.94)**	(-1.33)	(-1.99)*	(0.09)
MP	-1.66	-3.24	-3.08	-4.67	1.59
	(-0.77)	(-3.13)***	(-1.43)	(-3.58)***	(1.16)
GDPRATE	-0.26	0.064	0.080	0.40	-0.33
	(-1.01)	(0.46)	(0.36)	(1.31)	(-1.66)
CRISISDUMMY	-0.009	-0.010	0.002	0.001	0.001
	(-0.42)	(-0.75)	(0.11)	(0.05)	(0.14)
Constant	1.65	0.89	0.89	0.13	0.76
	(4.00)***	(3.59)***	(2.18)**	(0.28)	(2.36)**
Observations	169	169	169	169	169
R^2	0.49	0.49	0.32	0.42	0.38

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

[a] *GLCOWN* and *MA* are omitted from the regression models for small banks because none of the small banks in our sample was owned by Malaysian government-linked companies and agencies nor involved in merger and acquisition activities during the sample period.

[b] *PINDEX4* is used to proxy for aggregate stock market illiquidity because it is a composite index of *QSPPROP*, *AMIHUD*, inverse *DTVR* and *ZERORET*.

All variables are defined in Table 5.1.

Source: Author's calculations

5.4.5 Fixed-effect panel threshold model for the effect of bank competition on liquidity creation

Next, we adopt a fixed-effect panel threshold model introduced by Hansen (1999) to examine the non-linear threshold effect of bank competition on bank liquidity creation which is "structurally broken" or constrained by the size of banks. The model allows the sample data to endogenously decide the number of the threshold and the optimal threshold value by least squares method. Our baseline equation (5) is first extended to the single fixed-effect panel threshold model:

$$LC_{it} = \beta_1 LERNER_{it} I(TA_{it} < \gamma) + \beta_2 LERNER_{it} I(TA_{it} \geq \gamma) + \beta_3 X_{it} + a_i + u_{it} \quad (10)$$

where

i denotes individual bank and *t* denotes specific year;

$I(.)$ is the indicator function;

TA is the bank size threshold variable which represents total assets expressed in real 2013 MYR billion;

γ is the value of the threshold variable;

LC = bank liquidity creation measures as a proportion of total assets;

LERNER = bank market power as an inverse proxy for bank competition;

X = other explanatory variables including *SLIQUIDITY*, *EQR*, *lnTA*, *CREDIT_RISK*, *ZSCORE*, *GLCOWN*, *MA*, *IBSDUMMY*, *HHI_D*, *SCAPRATIO*, *MP*, *GDPRATE* and *CRISISDUMMY*

a = time-invariant unobserved individual effect;

u = idiosyncratic error term;

β = coefficients to be estimated.

If there are multiple thresholds, we fit the model sequentially. At the present, multiple-thresholds model permits dataset to be divided into four regimes by three thresholds, γ_1, γ_2 and γ_3. To determine the number of threshold in the model, it is important to determine whether the threshold effect is statistically significant. To do this, a threshold effect test is first conducted for the single-threshold model under the null hypothesis of no threshold effect (linear model). If the null hypothesis of no threshold effect is rejected, then a subsequent threshold effect test will be conducted for the double-threshold model under the null hypothesis of single threshold effect (single-threshold model). If both the single- and double-threshold models reject the null hypotheses, then a threshold effect test is conducted for the triple-threshold model under the null hypothesis of double threshold effect (double-threshold model).

Given the five bank liquidity creation measures in our study, we estimate the single-threshold model (equation 10) for each of the measures and report the results in Table 5.13. However, the total bank observations drops from 294 to 260 when the fixed-effect threshold model is adopted. This is because estimating the model with Stata requires a balanced panel dataset, so banks that do not have data throughout the 2001 to 2013 period are dropped from the analyses.

As indicated by the *p*-values of threshold effect tests across all the models in Table 5.13, all single-threshold models fail to reject the null hypothesis of no threshold effect, except for the single-threshold model of *CATFAT_TA* (model 1S) which passess the threshold effect test at the five percent significance level. Further, the double-threshold model of *CATFAT_TA* (model 1D) fails to reject the single-threshold effect with the *p*-value of 0.79. The results thus suggest a single-threshold model for the effect of *LERNER* on *CATFAT_TA.* Since *CATFAT_TA* is the preferred liqudity creation measure and since we are interested to examine the non-linear effect of bank competition on bank liquidity creation constrained by bank size, the results of Model 1S are used.

Based on the results of Model 1S, it is found that the effect of bank competition on total bank liquidity creation changes direction at the bank size threshold value of MYR 7.49 billion. Two regimes are then formed from our sample: one containing 81 bank observations that hold less than MYR 7.49 billion total assets (small bank regime), and the other containing 179 bank observations that hold at least MYR 7.49 billion total assets (large bank regime). Before reaching the threshold value, the estimated coefficient on *LERNER* is 0.24 and significant at the one percent level, indicating a negative effect of bank competition on total liquidity creation in the small bank regime, *ceteris paribus*. Upon reaching the threshold, the estimated coefficient on *LERNER* is -0.49 and is significant at the one percent level, suggesting that large banks increase their total liquidity creation when facing greater competition. In summary, the results based on the fixed-effect panel threshold model are consistent with the results using the split sample fixed-effect regression model and reaffirm that bank size is a moderating factor of the effect of bank competition on bank liquidity creation.

Table 5.13 Non-linear threshold effect of bank competition on bank liquidity creation

Threshold model	Single (1S)	Double (1D)	Single (2)	Single (3)	Single (4)	Single (5)
	CATFAT_TA	*CATFAT_TA*	*CATNONFAT_TA*	*MATFAT_TA*	*MATNONFAT_TA*	*OFFLC_TA*
LERNER($TA<\gamma_1$)	0.24	0.23	0.12	0.35	-0.013	0.12
	(3.99)***	(4.15)***	(2.95)***	(2.63)**	(-0.19)	(3.58)***
LERNER($\gamma_1 \leq TA<\gamma_2$)	-0.49	-0.51	-0.38	-0.003	0.20	-0.065
	(-4.19)***	(-5.82)***	(-4.65)***	(-0.02)	(2.45)**	(-0.74)
LERNER($TA\geq\gamma_2$)	-	-0.34	-	-	-	-
		(-2.71)**				
PINDEX4	-0.001	-0.001	-0.001	-0.001	-0.0005	-0.0001
	(-2.19)**	(-2.22)**	(-2.73)**	(-1.46)	(-1.70)	(-0.42)
lnTA	-0.097	-0.11	-0.021	-0.045	0.004	-0.079
	(-4.04)***	(-4.79)***	(-0.65)	(-1.36)	(0.15)	(-2.52)**
EQR	-1.12	-1.20	-1.02	-1.32	-1.04	-0.11
	(-2.41)***	(-3.64)***	(-3.01)***	(-3.02)***	(-2.61)**	(-0.55)
GLCOWN	-0.004	-0.019	-0.076	0.098	-0.014	0.068
	(-0.04)	(-0.26)	(-3.39)***	(2.12)**	(-0.13)	(0.75)
ZSCORE	-0.001	-0.0005	0.0003	0.002	0.001	-0.001
	(-0.29)	(-0.26)	(0.16)	(0.68)	(0.46)	(-0.64)
CREDIT_RISK	0.46	0.46	0.22	0.37	0.098	0.23
	(4.31)***	(4.33)***	(2.51)**	(3.52)***	(1.37)	(4.27)***
MA	-0.033	-0.033	-0.022	-0.001	0.008	-0.012
	(-1.78)*	(-2.02)*	(-1.51)	(-0.05)	(0.56)	(-0.76)
IBSDUMMY	-0.053	-0.060	-0.032	-0.097	-0.079	-0.025
	(-2.02)*	(-2.32)**	(-1.74)*	(-2.41)**	(-2.72)**	(-1.25)
HHI_D	3.71	3.19	4.62	2.49	3.14	-0.87
	(1.44)	(1.19)	(2.49)**	(0.90)	(1.45)	(-0.57)
SCAPRATIO	-0.087	-0.090	-0.086	-0.061	-0.064	0.003
	(-2.00)*	(-2.07)*	(-2.76)**	(-1.10)	(-1.62)	(0.14)
MP	0.078	-0.096	-0.54	0.66	0.19	0.92
	(0.05)	(-0.07)	(-0.45)	(0.35)	(0.12)	(0.94)
GDPRATE	-0.45	-0.51	-0.18	-0.46	-0.18	-0.25
	(-1.58)	(-1.72)	(-0.78)	(-1.34)	(-0.48)	(-1.74)*
CRISISDUMMY	-0.019	-0.022	-0.001	-0.007	0.009	-0.016
	(-1.09)	(-1.27)	(-0.11)	(-0.40)	(0.76)	(-1.33)
Constant	1.04	1.27	0.076	0.59	-0.013	0.96
	(2.92)***	(3.23)***	(0.19)	(1.32)	(-0.03)	(3.16)***
Observations	260	260	260	260	260	260
R^2	0.49	0.50	0.41	0.37	0.37	0.39
Threshold effect						
F-stat	27.9**	6.80	20.0	11.41	9.88	12.11
(*p*-value)	(0.040)	(0.79)	(0.14)	(0.53)	(0.72)	(0.51)
γ_1	7.49	7.49	7.49	4.11	109	7.11
γ_2	n/a	150	n/a	n/a	n/a	n/a

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis. ***, **, * denotes significance at 1, 5 and 10 percent levels, respectively. Source: Author's calculations

5.4.6 Dynamic effects of bank competition and stock market liquidity

All the regressions we analysed so far have implied instantaneous relationships between bank liquidity creation and bank competition and stock market liquidity, because we employ these variables from the same time period. Next, we test for the possibility that time might elapse between the changes in bank competition and stock market liquidity and the change in bank liquidity creation. We replace both *LERNER* and *SLIQUIDITY* from time period *t* in our baseline equation (5) by *LERNER* and *SLIQUIDITY* from *t*-1, as:

$$LC_{it} = \beta_1 LERNER_{it-1} + \beta_2 SLIQUIDITY_{it-1} + \beta_3 X_{it} + a_i + u_{it} \quad (11)$$

In equation (11), our explanatory variables of interest are lagged by one year, and the relationships between bank liquidity creation and control variables remain instantaneous.

Table 5.14 reports the regressions results on the dynamic effects of bank competition and stock market liquidity on bank liquidity creation. Based on the results for small banks presented in column (1), the marginal effect of *LERNER* on *CATFAT_TA* reduces from 0.23 to 0.11 and becomes significant at ten percent level when *LERNER* is lagged by one year. The results suggest that the dynamic effect of previous year's bank competition on current year's liquidity creation of small banks is weak. Further, based on the results for large banks presented in column (2), the estimated coefficient on one-year lagged *LERNER* is insignificant, suggesting that previous year's bank competition does not have a significant influence on liquidity creation of large banks.

Columns (3) to (7) in Table 5.14 show the results for full sample banks for which five stock market liquidity measures are employed alternatively in the regression model. It is found that the coefficients of *l.LERNER* across all the five models remain positive as in our main analyses, but become statistically insignificant. The findings suggest that when the competition faced by Malaysian commercial banks changes, banks adjust their liquidity creation for the non-bank sectors immediately or at least in the same time period, ceteris paribus. Generally, there is no dynamic effect of bank competition on liquidity creation in the Malaysian commercial banking industry. Besides, the impact of lagged stock market liquidity on bank liquidity creation becomes weak, as indicated by the negative coefficients on *l.AMIHUD* and *l.ZERORET* which are significant at ten percent level and *l.QSPPROP*, *l.DTVR* and *l.PINDEX4 which* are insignificant. This implies that current year's bank liquidity creation is not affected by last year's stock market liquidity as strongly as current year's stock market illiquidity, ceteris paribus. In summary, the effects of bank competition and stock market liquidity on bank liquidity creation in Malaysia are instantaneous. The dynamics of these effects are not apparent.

Table 5.14 Dynamic effects of bank competition and stock market liquidity on *CATFAT_TA*

	Small banks	Large banks	All banks				
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
l.LERNER	0.11	-0.41	0.011	0.017	0.010	0.017	0.012
	(2.09)*	(-1.49)	(0.21)	(0.29)	(0.19)	(0.29)	(0.22)
l.SLIQUIDITY							
l.QSPPROP			-0.004				
			(-1.08)				
l.AMIHUD				-0.002			
				(-1.82)*			
l.DTVR					-0.50		
					(-1.49)		
l.ZERORET						-0.005	
						(-1.93)*	
l.PINDEX4	-0.0001	-0.0003					-0.0003
	(-0.91)	(-1.44)					(-1.26)
lnTA	-0.12	-0.14	-0.15	-0.15	-0.12	-0.15	-0.15
	(-1.78)	(-1.44)	(-4.57)***	(-4.87)***	(-3.44)***	(-4.84)***	(-4.64)***
EQR	-0.94	-1.72	-1.45	-1.45	-1.38	-1.41	-1.45
	(-1.53)	(-0.89)	(-2.70)**	(-2.64)**	(-2.56)**	(-2.55)**	(-2.68)**
GLCOWN	5.02	-0.017	-0.073	-0.076	-0.054	-0.085	-0.073
	(1.19)	(-0.26)	(-0.78)	(-0.82)	(-0.63)	(-0.89)	(-0.78)
ZSCORE	-0.0001	-0.0001	0.001	0.001	0.001	0.001	0.001
	(-0.03)	(-0.02)	(0.43)	(0.37)	(0.39)	(0.30)	(0.41)
CREDIT_RISK	0.44	0.55	0.45	0.45	0.47	0.45	0.45
	(2.83)**	(2.98)***	(3.98)***	(3.92)***	(4.36)***	(3.97)***	(3.96)***
MA[a]	-	-0.049	-0.053	-0.046	-0.045	-0.051	-0.053
		(-1.70)	(-2.64)**	(-2.26)**	(-2.15)**	(-2.74)**	(-2.64)**
IBSDUMMY	-0.24	-0.022	-0.065	-0.066	-0.067	-0.067	-0.065
	(-2.95)**	(-0.95)	(-1.76)*	(-1.80)*	(-1.85)*	(-1.83)*	(-1.77)*
HHI_D	6.42	3.33	2.85	3.29	1.34	4.58	3.01
	(1.11)	(0.92)	(1.05)	(1.22)	(0.59)	(1.40)	(1.09)
SCAPRATIO	0.042	0.049	0.035	0.045	-0.019	0.087	0.041
	(0.75)	(2.36)**	(1.51)	(1.88)*	(-0.62)	(2.40)**	(1.72)*
MP	0.55	-1.25	0.94	0.039	0.63	1.92	1.17
	(0.12)	(-0.50)	(0.45)	(0.02)	(0.38)	(1.17)	(0.61)
GDPRATE	0.98	0.40	0.34	0.39	0.63	0.14	0.29
	(0.89)	(0.99)	(0.66)	(0.75)	(1.20)	(0.34)	(0.61)
CRISISDUMMY	-0.010	-0.015	-0.008	0.0005	0.006	-0.010	-0.007
	(-0.13)	(-0.83)	(-0.39)	(0.02)	(0.26)	(-0.50)	(-0.36)
Constant	0.15	1.40	1.18	1.22	1.18	1.11	1.17
	(0.16)	(1.51)	(3.09)***	(3.20)***	(2.76)***	(2.78)***	(3.04)***
Observations	102	164	267	267	267	267	267
R^2	0.42	0.46	0.39	0.40	0.39	0.40	0.39

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.
***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

[a] *MA* is omitted from the regression models for small banks because none of the small banks in our sample was involved in merger and acquisition activities during the sample period.
Small banks are defined as banks holding total assets of up to MYR20 billion and large banks are banks holding total assets exceeding MYR20 billion.
All variables are defined in Table 5.1.
Source: Author's calculations

5.4.7 Instrumental variable estimation and test for endogeneity

This additional test is conducted to test and address possible endogeneity of the explanatory variables of our study interest, specifically bank competition and stock market illiquidity, for which the fixed-effect estimator may fail to account. A critical assumption of the fixed-effect estimator (or within estimator) is strict exogeneity of explanatory variables, that is $E(u_{it}|x_{it}, a_i)=0$ for all $t=1, \ldots, T$ (Wooldridge, 2013). The assumption implies that the fixed effects estimator will not be consistent in the presence of time-varying omitted variables that are correlated with the explanatory variables, even after it takes out the unobserved fixed effects. Instrumental variables (IV) method has been a popular and consistent estimator in solving such endogeneity problem, however, the method comes with a costly efficiency loss when the explanatory variables are exogenous (Wooldridge, 2013). As such, it is useful and important to test for endogeneity of bank competition and stock market illiquidity to show whether the IV method is necessary in our study. We employ the robust Durbin-Wu-Hausman test of endogeneity in the context of panel IV estimation with a two-stage least-squares (2SLS) fixed-effects estimator[33]. The 2SLS fixed-effects estimator is obtained in two stages. The first stage regresses the potentially endogenous variable (bank competition or stock market illiquidity) on at least one excluded instrument and all other control variables. In the second stage, bank liquidity creation (using the preferred *CATFAT_TA*) is regressed on the predicted value for the specified endogenous variable obtained from the first stage and all the control variables. As with the fixed-effects estimator employed in our main analyses, a fixed effects transformation is imposed on the 2SLS estimations to control for unobserved bank fixed effects.

The consistency of the IV method and its diagnostics tests for endogeneity and over-identifying restrictions is underpinned by several key assumptions. One of them is the homoscedasticity assumption for the usual 2SLS standard errors and tests statistics to be asymptotically valid (Wooldridge, 2013). We, thus, make these tests robust to heteroscedasticity and autocorrelation using cluster-robust standard errors. Besides, an instrument (z) for the endogenous explanatory variable (x) must satisfy two assumptions: (i) instrument exogeneity or z is uncorrelated with the

[33] In Stata version 11 (or later), endogeneity test statistics can be easily performed using "endog" option of xtivreg2.

unobserved error term (*u*), and (ii) instrument relevance or *z* is strongly correlated with *x* (Wooldridge, 2013). The instrument exogeneity requirement cannot be tested when the number of excluded instruments is equal to the number of specified endogenous regressors (the equation is exactly identified). In the over-identification case, over-identifying restrictions can be tested under the null hypothesis that the excluded instruments are valid (exogeneous) instruments, which means that the instruments are uncorrelated with the error term and are correctly excluded from the estimated model. The robust test of over-identifying restrictions follows Hansen's *J* statistic. Whereas, the relevance requirement of instrument can be tested jointly using a *F*-test or individually using a *t*-test in the first stage regression (Wooldridge, 2013).

In the IV estimations dealing with possibly endogenous bank competition, two country-level institutional factors and a bank-level variable are identified as valid and relevant instruments. The first institutional factor is financial freedom (*FINANCIALFREE*), an index score of independence from government control and interference in the financial sector ranging 0 (repressive) to 100 (negligible government interference) (The Heritage Foundation, 2016). Financial freedom is vital to ensure all financial institutions, including foreign institutions, operate freely and without government influence and are treated equally (Mirzaei & Moore, 2014). As such, financial freedom weakens the market power of banks and boosts bank competition.

Property rights (*PROPERTYRIGHT*) is another institutional determinant of bank competition. The property rights index score measures the degree to which a country's laws protect private property rights and the extent to which those laws are enforced effectively (The Heritage Foundation, 2016). Effective legal protection of property encourages banks to freely accumulate private property, designating boundaries in the banking sector within which innovative banks develop their market power and exert greater competitive pressure on less innovative competitors (Maskus & Lahouel, 2000). Property rights index score ranges from 0 (private property is outlawed) to 100 (private property is government-guaranteed), and the data is available each year from the Heritage Foundation (2016). *FINANCIALFREE* is a valid instrument for bank competition facing the full sample banks and the large banks, while *PROPERTYRIGHT* is a valid instrument for competition facing small banks.

Bank competition is measured at bank-level, thus it is important to have a bank-level instrument for bank competition to show sufficient variation across banks and over time. Since it is very difficult to find a valid instrument at bank-level, lagged bank competition is used as an instrument. The first stage *F*-statistic and the over-identification test reported in Panel A of Table 5.15 confirms that

lagged bank competition is strongly linked to current bank competition and is exogenous in the regression model.

In addition, two instruments are identified for stock market liquidity, which are investment freedom (*INVESTFREE*) and political stability and absence of violence (*POLITICSA*). *INVESTFREE* captures the degree of regulatory restrictions imposed on investment capital, with the ideal score of 100 for constraints-free to the score of 0 for the maximal constraints (The Heritage Foundation, 2016). Previous cross-country studies have found that liberalisation of capital controls boosts stock market size, liquidity and international integration (Demirgüç-Kunt & Levine, 1996a; Demirguc-Kunt & Maksimovic, 1996; Levine & Zervos, 1998). *POLITICSA* measures perceptions of the likelihood of political instability and politically-motivated violence, including terrorism (World Bank, 2015). The estimate ranges from -2.5 (weak governance performance) to 2.5 (strong governance performance). Due to the fear of capital loss, the adverse impact of political instability on stock market risk and performance has been found to be substantial, impeding the market liquidity and development (Asteriou & Siriopoulos, 2000; Roe & Siegel, 2011).

Table 5.15 shows the regression results of the two stages in IV estimations, with Panel A of the table addressing possibly endogenous bank competition and Panel B addressing possibly endogenous stock market liquidity. The results of the first stage *F*-statistics and the Hansen's *J*-statistics reported in both panels show that our excluded instruments for bank competition and stock market liquidity are jointly relevant and valid – important requirements for a valid and consistent endogeneity test and IV estimation. In addition, the signs of the coefficients on these instruments obtained in the first-stage regressions are as expected.

As demonstrated in Panel A of Table 5.15, the Durbin-Wu-Hausman endogeneity test fails to reject the null hypothesis that the specified endogenous regressor is exogenous, which suggests that bank competition can be treated as exogenous and that the IV estimator is not necessary for our regression model. We also report the second-stage IV regression results in Panel A. In the regression for small banks, the coefficient on the *LERNER* coefficient increases from 0.23 in the fixed-effects estimation to 0.38 but becomes insignificant. The IV estimate of *LERNER* coefficient for large banks increases from -0.31 to -0.74 and improves slightly in terms of statistical significance. On the other hand, for the full sample banks, the IV estimate of the *LERNER* coefficient reduces to 0.048 from 0.17 (the fixed-effects estimate) and becomes insignificant. We are not surprised by the less significant estimates of *LERNER* since the IV estimates always have very large standard errors.

Similarly, the results of the Durbin-Wu-Hausman endogeneity test reported in Panel B of Table 5.15 suggest that our stock market liquidity measures can be treated as exogenous in the model, except for *DTVR*. Using the IV estimator to address the endogenous *DTVR*, we note that the coefficient of *DTVR* changes to positive (1.71) as opposed to the negative coefficient (-1.15) reported by the fixed-effects estimation. This finding indicates that the higher the stock market turnover ratio (greater stock market liquidity), the greater the magnitude of bank liquidity creation. The finding for *DTVR* is now consistent with the findings based on stock market illiquidity measures. We are, again, not surprised by the insignificant estimates of these stock market liquidity measures for the same reason discussed in the previous paragraph - IV estimates always have very large standard errors.

To summarise, the Durbin-Wu-Hausman endogeneity tests in the context of fixed-effects IV estimation fail to reject the exogeneity of bank competition and stock market liquidity, in most cases. Based on these results, it is fair to assert that any leftover neglected time-varying heterogeneity is not correlated with our explanatory variables of interest and the strict exogeneity assumption of the fixed effects estimator is satisfied. Hence, there is no need to resort to the less efficient IV approach as the asymptotic variance of the IV estimator is always larger (Wooldridge, 2013). The use of the fixed effects estimator that allows consistent estimation of the model in this study is, thus, justified.

Table 5.15 Fixed-effects IV analysis and test of endogeneity

Panel A: Effect of *LERNER* on *CATFAT_TA* (corresponding to research objectives one and two)

	Small banks	Large banks	All banks
First-stage regression results			
l.LERNER	0.36	0.59	0.41
	(1.88)*	(11.9)***	(3.62)***
FINANCIALFREE		-0.004	-0.004
		(-5.49)***	(-1.97)**
PROPERTYRIGHT	0.017		
	(1.00)		
Control variables	Yes	Yes	Yes
First stage *F*-statistic	7.14**	71.6***	9.17***
Second-stage regression results			
LERNER (instrumented)	0.38	-0.74	0.048
	(1.45)	(-1.83)*	(0.39)
PINDEX4	-0.002	-0.001	-0.0008
	(-1.87)*	(-2.58)**	(-2.12)**
Control variables	Yes	Yes	Yes
Second stage *F*-statistic	2,583***	23.1***	9.73***
R^2	0.43	0.45	0.40
Hansen's *J*-statistic	1.27	0.040	0.14
(χ^2 *p*-value)	(0.26)	(0.84)	(0.71)
Durbin-Wu-Hausman statistic	0.60	1.66	0.49
(χ^2 *p*-value)	(0.44)	(0.20)	(0.48)
Observations	101	164	266

Panel B: Effect of stock market liquidity on *CATFAT_TA* (corresponding to research objective three)

	QSPPROP	*AMIHUD*	*DTVR*	*ZERORET*	*PINDEX4*
First-stage regression results					
POLITICSA	-3.92	-12.5	-0.005	-1.38	-51.6
	(-13.8)***	(-8.25)***	(-0.68)	(-2.32)**	(-10.2)***
INVESTFREE	-0.091	-0.40	0.0008	-0.083	-1.63
	(-7.74)***	(-6.38)***	(5.32)***	(-5.42)***	(-8.37)***
Control variables	Yes	Yes	Yes	Yes	Yes
First stage *F*-statistic	312***	148***	19.0***	14.7***	194***
Second-stage regression results					
SLIQUIDITY (instrumented)	-0.006	-0.002	1.71	-0.016	-0.0006
	(-0.59)	(-0.78)	(0.94)	(-0.92)	(-0.78)
LERNER	0.17	0.17	0.17	0.16	0.17
	(5.18)***	(5.28)***	(5.46)***	(4.70)***	(5.24)***
Control variables	Yes	Yes	Yes	Yes	Yes
Second stage *F*-statistic	21.9***	20.7***	19.4***	20.7***	20.6***
R^2	0.41	0.42	0.34	0.42	0.41
Hansen's *J*-statistic	0.88	0.76	0.020	0.47	0.75
(χ^2 *p*-value)	(0.35)	(0.38)	(0.89)	(0.49)	(0.39)
Durbin-Wu-Hausman statistic	0.61	0.44	2.94	0.067	0.40
(χ^2 *p*-value)	(0.43)	(0.51)	(0.09)*	(0.80)	(0.53)
Observations	294	294	294	294	294

Note: *t*-statistics based on cluster-robust standard errors are in parenthesis.

***, **, * denotes significance at 1, 5 and 10 percent levels, respectively.

All variables are defined in Table 5.1.

Source: Author's calculations

5.5 Result discussions

This section discusses the empirical findings for the research objectives.

5.5.1 Result discussion for research objective one

The first research objective of this study is to examine and compare the relationship between bank competition and liquidity creation for small and for large commercial banks in Malaysia.

Small commercial banks In Malaysia operate only three branches, on the average, usually in developed cities such as Kuala Lumpur and target niche markets based on high value corporate clients (BNM, 2001; The Association of Banks in Malaysia, 2016). For example, Bank of China (Malaysia) and Industrial and Commercial Bank of China (Malaysia) have a niche in international trade financing business, particularly in Renminbi products, including trade loans, and as a one-stop provider of banking services related to business in China; Bank of Nova Scotia specialises in business banking to large and medium-sized corporations and retail banking to medium and high net worth individuals; BNP Paribas Malaysia and Mizuho Corporate Bank (Malaysia) target a segmented group of corporates including subsidiaries of multinationals, sovereigns and financial institutions. As these valued corporate clients embody the profitability and sustainability of small banks, they usually receive exclusive services and attention from the banks in the drive to deepen relationships to increase their share of the wallets of the clients. More importantly, in virtue of the flat organisational structure, small banks have a greater comparative edge than large banks in the processing and communication of information across hierarchy levels and the delegation of decision making authority. This allows soft-information, gathered during the course of the bank officers' personal contact with their clients and local community, to play a role in the small banks' decisions related to product and service provision (Berger & Black, 2011; Berger & Udell, 2006; Berger et al., 2005b; Cole et al, 2004; Stein, 2002). In particular, the comparative edge of small banks in the use of soft information enables small banks to extend credit to informationally-opaque or riskier customers not served by large banks that prefer hard information such as financial statements and collateral. The benefits of extending relationship lending to these customers, including an *ex post* monopoly of information and the ability to hold on to customers, have been documented by Berger et al. (2005b), Degryse and Van Cayseele (2000) and Rajan (1992).

The empirical evidence in this study reveals that, regardless of the "category" or "maturity" specification of bank liquidity creation measures, bank competition has a negative relationship with liquidity creation by small banks, through both on-the balance sheet and off-the balance sheet

activities. This result is consistent with the "fragility channel" hypothesis that an increase in bank competition erodes banks' incentives to create liquidity for the public because it becomes more difficult for banks to internalise the benefits of the banking relationships with their clients who face low switching cost as a result of bank competition (Petersen & Rajan, 1995; Dell'Ariccia & Marquez, 2004; Hauswald & Marquez, 2006). Specifically, small banks are likely to cut down their soft lending to new, informationally-opaque or riskier borrowers to avoid bearing substantial informational and monitoring costs related to adverse selection in the early relationship period and free ride on the borrowers' information by other lending competitors.

More importantly, with the existence of the credit bureau in Malaysia, the value of borrowers' information to banks diminishes substantially because the credit bureau allows banks to make informed lending decisions and compete for borrowers[34] (Pagano & Jappelli, 1993; Padilla & Pagano, 1997). In other words, the value of the bank-borrower relationship for both banks and borrowers suffers and the relationship breaks down easily. Greater competition imposes constraints on the ability of banks to capture the customers and to share in surpluses of borrowers, because borrowers are tempted to switch to a bank that offers better credit terms or to a capital market. Accounting for the monitoring cost borne for informationally-opaque customers, small banks that encounter strong competition may then find it less worthwhile to extend soft loans to informationally-opaque customers. This argument also explains our result that, when facing an increase in competition, small banks cut down their off-balance sheet credit commitments (a type of relationship lending arrangement)[35].

Instead of investing in more informationally opaque or risky customers, small banks that face greater competition may reallocate resources towards their existing captured customers by encouraging the existing customers to continuously utilize their products and services through strengthened customer relationship management. Such a phenomenon has been found and referred to as a "flight to captivity" by Dell'Ariccia and Marquez (2004).

In addition, given a narrower business focus of small banks in Malaysia, their capacity to expand their liquidity creation is limited, amidst interest margin compressions on both asset and liability

[34] The credit bureau in Malaysia, managed by BNM, has been in operation since 1982 (BNM, 2014b). The credit bureau centralizes and disseminates both positive and negative credit information and ratings on borrowers to all institutional members including banking institutions (BNM, 2014b). The supply of credit information by lending institutions is made compulsory, and the information must be timely and accurate.

[35] Off-balance sheet credit commitments, which constituted about 74 percent of total off-balance sheet liquidity creation by our sample banks, are often treated as a type of relationship lending arrangements by literature, such as Berger and Udell (1995), Boot and Thakor (2000) and Dinc (2000).

sides. Their capacity to attract greater sources of funding and demand for their financial products is constrained by small branch networks, narrow technology diffusion and limited business opportunities arising from the economic development, as customers often look for financial solutions with safe and dominant bank names and reputations (Siow, 2016). Thus, their liquidity creation role is hurt more than that of large banks when facing greater competition.

On the other hand, this study finds evidence of the "price channel" effect for large banks in the regression models based on the preferred "category" specification of bank liquidity creation (*CATFAT_TA* and *CATNONFAT_TA*) because the estimated coefficient on *LERNER* is significantly negative. The "price channel" hypothesis asserts that bank competition is positively associated with bank liquidity creation (Hannan, 1991; Guzman, 2000; Carbó-Valverde et al., 2009). The empirical evidence does not show a significant relationship between bank competition and the off-balance sheet liquidity creation. Thus, it appears that an increase in competition facing large banks impacts their liquidity creation mainly through their balance sheet activities. This result can be possibly explained through specialisation in lending technologies based on hard-information and capacity of large banks in Malaysia.

As suggested by organisational form studies, large banks generally specialise in hard-information-based lending technologies, such as asset-based lending and credit-scoring, that help to mitigate the agency problem within the banks (Berger & Black, 2011; Berger & Udell, 2006; Berger et al., 2005; Cole et al, 2004; Stein, 2002). This comparative edge allows large commercial banks in Malaysia to serve mass consumers and corporate customers at arm's length through extensive branch networks (152 branches, on average, from the year 2010 to 2013) throughout the country (BNM, 2001; The Association of Banks in Malaysia, 2016). Because large banks do not rely on soft information of customers as heavily as small banks when transacting with informationally-opaque or riskier customers, large banks are buffered against the "fragility channel" effect of bank competition on bank liquidity creation activities. The switching cost borne by large banks is not as severe as that for small banks in the face of greater bank competition.

A large body of literature has also acknowledged that adoption of small business credit-scoring technology alleviates information and underwriting costs traditionally faced by large banks in small business lending and thus credit rationing on small firms (Akhavein et al., 2005; Berger et al., 2005a; Frame et al., 2001; Petersen & Rajan, 2002). As the problem of under-pricing risky loans is mitigated, large banks may allocate more credit to previously unserved borrowers, and the incentive to do so intensifies when competition increases. For instance, in the year 2012, the largest commercial bank

in Malaysia, Maybank, was reported to be applying the risk based pricing strategy to improve the bank's margin and market share, amid increasing competition (Malayan Banking Berhad, 2013).

In addition, the strong capacity of large commercial banks in Malaysia helps to explain why large banks are able to create more liquidity for the economy when facing increased competition. The capacity of Malaysian large banks is particularly evident in the forms of extensive branch operations and delivery channels, reputation, staff force and technology diffusion. Besides having extensive branch networks, some large banks form alliances with supermarkets and post offices to reach customers in the rural areas, as part of their branch network rationalisation exercise (BNM, 2001). In the midst of rising competition, large banks are able to tolerate lower pricing power and leverage their presence in new and existing markets at a faster pace by offering a bundle of innovative and competitive financial products and services to attract a different mix of customers. This in turn allows the banks to expand the pool of deposit funds available for greater loan demand. Over the years, the liquidity provider role of some DFIs has been becoming redundant as a result of greater participation of large banks in market segments served by the fringe Institutions (World Bank, 2013). For example, Bank Pembangunan Malaysia that provides medium to long term financing only to infrastructure, maritime, technology, oil and gas sectors and the SME Bank that targets only Malaysian SMEs are losing their competitiveness as large commercial banks are already providing most of the financing in these areas.

Besides competing for local markets, some large banks have looked for business opportunities beyond the national border to help buffer the adverse impact of competition. For example, in the year 2013, United Overseas Bank (Malaysia) set up the Foreign Direct Investment (FDI) advisory unit to assist foreign companies which are expanding their business into Malaysia by offering access to the bank's full suite of corporate and personal banking products and borderless financial services. Through the advisory unit, the Bank expects to double its corporate loans to foreign companies investing in Malaysia in the next three years (UOB (Malaysia) Berhad, 2014).

In addition, large banks have always been at the forefront of technology innovation for the financial services sector. Owing to high fixed costs, large banks generally adopt new technologies earlier than smaller banks, such as internet and mobile banking and small business credit-scoring technology, allowing them to serve a broad range of customers at arm's length, gain a significant market share and enjoy economies of scale. A good example is the locally incorporated Citibank which has a comparative edge in bringing innovative technology to the market (Citibank Berhad, 2014). Citibank was the first bank to introduce a 10-minute home loan approval tool, cutting short the average

waiting period of five to seven days. The bank's automated teller machines (ATM), known as Citibank Express, also offer most of the banking transactions including the opening of accounts to deliver efficient services and convenient processes for customers and expand the customer base.

In sum, the disparities in the lending technology specialisation and capacity of banks may provide an explanation as to why an increase in competition leads to a fall in the liquidity creation of small banks, while an increase in competition improves the liquidity creation of large banks.

5.5.2 Result discussion for research objective two

The second research objective of this study examines the dominant effect of bank competition on liquidity creation by the Malaysian commercial banks. The overall empirical evidence for the second research objective shows that, on average, commercial banks cut down their liquidity creation for the economy when they face increased competition, *ceteris paribus*, pointing to the dominant "fragility channel" effect over the "price channel" effect in the industry. The result is consistent with Horvath et al. (2013, 2016), Jiang et al. (2016), Joh and Kim (2012) and Xu (2010) who supported the "fragility channel" hypothesis for banks in the Czech Republic, the U.S., 25 OECD countries and 26 European countries, respectively.

According to the "fragility channel" hypothesis, an increase in bank competition reduces bank liquidity creation, particularly, by imposing credit rationing on informationally opaque or risky borrowers, because it becomes more difficult for banks to internalise the benefits of banking relationships with their clients who are tempted to switch banks or to a capital market that offers better financing choices (Petersen & Rajan, 1995; Dell'Ariccia & Marquez, 2004; Hauswald & Marquez, 2006; Horvath et al., 2013, 2016). This means that banks that establish relationships with informationally opaque borrowers no longer benefit from the *ex post* monopoly on information of their borrowers developed during the course of the bank-borrower relationship. In fact, such a phenomenon is taking place in Malaysia, where SMEs - often regarded as informationally-opaque customers in the literature - face greater obstacles in obtaining bank financing via soft lending arrangements technologies which are more valuable to SMEs. Owing to severe asymmetric information problems, bank loan issuances to SMEs tend to be more transaction-oriented when facing increased competition, meaning that potentially viable customers may be rejected credit if they cannot provide adequate collateral and track records. Bank loan approvals for SMEs are mainly backed with collateral that includes property and fixed deposits - a form of hard information (SME Corporation Malaysia, 2016).

Besides, to ease bank credit constraints on viable yet informationally-opaque SMEs, the Credit Guarantee Corporation (established by BNM on July 5, 1972) has been expanding its SME outreach via strategic alliances with leading banks, more branch networks and various guarantee schemes to provide guarantees for bank loans obtained by these SMEs (Credit Guarantee Corporation Malaysia, 2014). While the findings of this study report a decrease in liquidity creation by commercial banks facing an increase in competition, the findings can be explained by the banks' loan portfolio rebalancing strategy that favours customers who are backed by hard information[36]. Soft lending technology is not used massively for new, informationally opaque customers to alleviate costs related to informational asymmetry. The existence of an asymmetric information problem in the banking industry has substantial weight in explaining why the "fragility channel" effect of bank competition outweighs the "price channel" effect in Malaysia.

Another possible explanation for the negative relationship between bank competition and liquidity creation found collectively for Malaysian commercial banks is that banks reallocate funds towards liquid asset investment such as cash reserves and securities. As Carletti and Leonello (2011) suggest, the opportunity costs of holding reserves are low when an increase in bank competition makes bank lending activities less profitable. Hence, banks have greater incentive to invest less in illiquid loans and keep more liquid reserves within themselves. Investment in liquid assets also carries a benefit in shielding the banks from liquidity and credit risks during economic downturns.

The negative relationship between bank competition and liquidity creation can further be explained by banks' greater income diversification from interest-based towards non-interest-based (Amidu & Wolfe, 2013). It is evident that most banks in Malaysia, ranging from small to large banks, have placed more emphasis on increasing fee-based income in recent years to mitigate the heightened pressures on net interest margins as a result of the increased level of competition[37]. Although the principal source of banks' income is still driven by liquidity creation activities in the form of interest income, the growing focus on fee-based activities will lead to a moderation of banks' liquidity creation role. This is because fee-based activities, with the exception of off-balance sheet loan commitments, do not generally contribute to liquidity creation. Banks desire fee income-based activities, such as custody, wealth and cash management services and remittance business, as these

[36] The explanation also implies that increased bank competition benefits banks that specialize in hard-information-based technologies more, which explains the increase in liquidity creation by large banks, as has been observed for the first research objective.

[37] We found the evidence from banks' annual reports in recent years. For example, Affin Bank, Public Bank, locally incorporated Tokyo-Mitsubishi UFJ Bank and locally incorporated UOB Bank have reported intensifying their efforts to grow fee-based income as part of their business strategies to accommodate increasing competition.

activities do not alter the banks' risk position and capital structure as much as interest-based activities do.

5.5.3 Result discussion for research objective three

The third research objective of this study is to examine the relationship between stock market liquidity and bank liquidity creation in Malaysia. The empirical evidence reveals that stock market liquidity has a significantly positive link with liquidity creation by commercial banks in Malaysia. It appears that a liquid stock market explains aggregate liquidity creation as well as on- and off-balance sheet liquidity creation of banks. The results are consistent with previous studies that provide various plausible explanations for the relationship.

First, the positive relationship between stock market liquidity and bank liquidity creation can be explained through the risk-smoothing ability of a liquid stock market. As bank liquidity creation theory states, agents who have excess liquidity (savers) face a trade-off between liquidity insurance and return on illiquid asset investment as they are uncertain of their future consumption pattern (Bryant, 1980; Diamond & Dybvig, 1983; Jacklin, 1987). A liquid stock market can, however, alleviate the trade-off problem for investors, because the market provides profitable investment opportunities for investors if they are patient enough to reap the return or ready exit-options if they face an idiosyncratic consumption shock (Mattana & Panetti, 2014). As investors are able to liquidate their claims on the liquid stock market at ease and at low transaction cost, their liquidity demand from banks can be diverted away to some degree. This permits banks to accept larger asset-liability mismatches, both liquidity and maturity, by channelling more liquidity from liquid reserves towards illiquid asset investments (Mattana & Panetti, 2014; Sarr & Lybek, 2002). In this way, stock market liquidity increases the liquidity creation of banks.

Our result is also consistent with Chatterjee (2015) and Song and Thakor (2010) who document that stock market liquidity supports bank liquidity creation by relieving banks' cost of equity capital. Their explanation is actually more viable if the bank is publicly listed or has access to the stock market. We do not rule out the explanation because most of the large Malaysian commercial banks are either publicly listed or subsidiaries of listed financial holding companies. In fact, we can observe the result being carried through to the liquidity creation of large banks in Panel B of Table 5.6 in Section 5.3.1 (although this is not part of the research objectives). Chatterjee (2015) and Song and Thakor (2010) explained that, as a bank's cost of equity capital decreases in a liquid stock market, the bank is more attracted to employing a larger amount of equity capital to meet the higher capital requirements, such as Basel III's capital adequacy ratio, associated with greater lending scope for potentially

creditworthy yet previously unserved borrowers. This means that additional loans can be originated by the bank for greater scope of borrowers as the liquid stock market cuts down the bank's cost in maintaining its solvency.

The third possible explanation for the positive relationship between stock market liquidity and bank liquidity creation is that increased stock market liquidity encourages external inflows into Malaysia and thus stronger growth in deposit funding available for bank liquidity creation. Since foreign investors account for about a quarter of the total share ownership and trading value on the Malaysian stock market (24% and 26%, respectively, in the year 2013), the liquidity of the stock market can be a key driver of the country's broad money growth, especially through portfolio investments, which is reflected in the growth of deposits placed by domestic non-bank financial institutions and business firms with domestic commercial banks (BNM, 2016c). As increased stock market liquidity is associated with greater deposit funding available, commercial banks are able to issue more credit and create more liquidity.

While a liquid stock market motivates corporate firms to raise capital directly from investors, instead of through bank intermediaries, the firms often seek bank guarantees and commitments that serve as a primary backup source of corporate financing in the case that the firms fail to raise sufficient funds (Rajan, 1998; Dinc, 2000). In other words, despite the potential competition with banks for firms' external financing, a liquid stock market stimulates greater use of off balance sheet credit commitments, creating an opportunity for banks to create more liquidity.

Furthermore, our result can be supported by the literature in the strand of financial development and economic growth. For example, Demirguc-Kunt and Levine's (1996a), Demirgüç-Kunt, A., & Levine, R. (1996b) and Demirgüç-Kunt and Maksimovic (1996) found that, in a developing stock market, further increase in the market development (proxied by stock market capitalization and turnover) leads to a rise in large firms' demand for bank loans. Large firms' borrowing capacity tends to increase with their equity financing ability as they are "certified" by the stock market. Thus, we expect our result related to the positive association between stock market liquidity and bank liquidity creation can be partly explained by these previous findings since the Malaysian stock market is still striving to reach the status of full development.

Our result does not quite agree with the conventional theory that suggests the "crowding-out effect" of a liquid stock market on the liquidity creation of banks (Diamond, 1997; Haubrich & King, 1990; Jacklin, 1987; von Thadden, 1998; Wallace, 1988). The "crowding-out effect" implies that increased

stock market liquidity exerts a competitive pressure on commercial banks and increasingly replaces the banks' liquidity creator role in the economy. These theories often overemphasise the traditional products offered by commercial banks, specifically demand deposits and commercial loans, and overlook the changes in the micro-economy and the banks' innovations along with the development of the liquid stock market, for instance, a dynamic pool of borrowers and depositors, the risk-bearing capacity of banks and the off-balance sheet offerings of banks. Thus, this study supports the hypothesis that stock market liquidity enhances the liquidity creation of commercial banks in Malaysia.

Chapter 6

Conclusion

6.1 Introduction

This chapter begins by reviewing the significance and method of the study in Section 6.2. Section 6.3 summarises the empirical findings and suggests policy implications drawn from the findings. Section 6.4 discusses the limitations of the study, before recommending possible future research avenues in Section 6.5.

6.2 Study overview

The extant literature has enhanced our understanding of the links between bank competition and bank liquidity creation and between stock market liquidity and bank liquidity creation, and very often, the links come from two contradictory directions and are inconclusive for other countries that have not been examined. By examining the issues using a novel dataset from Malaysia, this study fills the gaps in the literature and generates policy implications.

The dataset from Malaysia is unique for several main reasons. First, the playing field for the large and small commercial banks is unequal due to substantial disparities in the branch network, technology specialisation and benefit from the government initiatives for economic development. Second, the adoption of dual-banking in Malaysia implies that commercial banks do not only encounter competition from other commercial banks, but also from Islamic banks. Specifically, with the supportive government initiatives, Islamic banking has been growing rapidly in recent years and has exerted direct competitive pressure on commercial banks in the consumer lending and deposit markets. Third, the Malaysian stock market has been large in terms of market capitalisation, but highly illiquid for a long time, which is a rare phenomenon compared to the large and liquid stock markets of the U.S. and U.K. It is interesting to investigate how the stock market liquidity is related to the liquidity creation of commercial banks in Malaysia and suggest implications for policy makers.

The study sample comprised almost all commercial banks operating in Malaysia from the period 2001 to 2013. We classified the sample banks into large and small banks using a cut-off point of MYR20 billion total assets expressed in real 2013 MYR for our main analysis, and other cut-off points of median total assets (MYR 34.5 billion expressed in real 2013 MYR) and of 16 bank branches for our additional tests. All the bank-level data were drawn from banks' annual reports. The aggregate stock

market data were obtained from Bursa Malaysia, while individual stock data were obtained from DataStream database. Macroeconomic and other country-level data were obtained from the Department of Statistics Malaysia and the Central Bank of Malaysia, the Heritage Foundation and the World Bank databases.

This study constructs four alternative measures of bank level liquidity creation following the three-step procedure developed by Berger and Bouwman (2009). These measures denote total liquidity creation and on-balance sheet liquidity creation based on the category and maturity classification approaches. We also develop an additional measure of bank liquidity provision through off-balance sheet components only to offer a different perspective for the empirical relationships of interest. Besides, to allow the measurement of competition faced by individual banks at a particular point of time, this study employs a non-structural competition measure known as the Lerner Index of pricing power. Further, to offer a deeper insight into stock market liquidity in Malaysia, this study computes various alternative stock market liquidity measures, which are quoted bid-ask spread, Amihud's illiquidity ratio, turnover ratio, frequency of trading days with zero returns and our own computation of aggregate stock market illiquidity index score. All regression analyses in this study are estimated using the fixed-effects estimator to account for bank heterogeneity that may contribute to the endogeneity issue for our findings.

6.3 Summary of the findings for the research objectives

6.3.1 Research objective one

The first research objective aims to examine and compare the relationship between bank competition and liquidity creation of Malaysian commercial banks by bank size. The results show that, irrespective of the "category" or "maturity" specification of the bank liquidity creation measure, bank competition has a negative relationship with the on-balance sheet and total liquidity creation by small banks, supporting the "fragility channel" hypothesis. The result can be explained through soft lending in which the small banks have an edge but becomes less valuable for the banks when facing an increase in competition. Extending soft loans to informationally-opaque or riskier customers implies that the banks have to bear greater monitoring and informational costs related to adverse selection in the early relationship with the customers. However, with the existence of the credit bureau in Malaysia and the increase in competition from other lenders, these customers are encouraged to switch banks when they become established. As competition slashes the profit margin and customer retention of the small banks, the banks ration credit on informationally-opaque customers and reallocate the credit towards their incumbent (or captured) customers. Our

explanation through the soft lending activities of small banks can, in fact, be supported by additional evidence for the negative link between bank competition and the off-balance sheet liquidity creation of small banks, because the off-balance sheet activities largely comprise credit commitments which are treated as relationship lending arrangements by some literature, such as Berger and Udell (1995), Boot and Thakor (2000) and Dinc (2000). However, it is important to emphasise that the objective of this study is not to establish the link between bank competition and soft information-based lending.

On the other hand, the study finds evidence in favour of the "price channel" hypothesis for large banks, suggesting that an increase in competition encourages large banks to increase their liquidity creation. The positive relationship is evident for the on-balance sheet liquidity creation of the large banks and does not carry through the banks' off-balance sheet liquidity creation undertakings. The specialisation in hard lending technologies and the strong capacity of large banks, for example, in terms of extensive branch networks and delivery channels, technology diffusion and reputation, provide possible explanations for the scope and opportunities of the banks to create more liquidity (issue more illiquid loans and accept more liquid deposits) for the public when they encounter greater competition. A pragmatic way of achieving this is to serve fringe or underserved market segments by expanding into new markets locally or across borders and applying lending technologies that suit the markets.

6.3.2 Research objective two

The second research objective aims to examine the dominant bank competition-liquidity creation relationship in the Malaysian commercial banking industry. The results show that despite the opposite relationship between bank competition and liquidity creation reported for small and large banks, on average, Malaysian commercial banks cut down their liquidity creation both on- and off-balance sheet when they face an increase in competition, *ceteris paribus*, pointing to the "fragility channel" effect dominating in the industry. It appears that the informational asymmetry issue has a greater weight in the banks' lending decisions to the public when competition increases, and as a result, banks reallocate credit towards customers who are backed by hard information such as collaterals and guarantees.

Another possible and more direct explanation for the negative relationship between bank competition and liquidity creation found collectively for Malaysian commercial banks is that banks reallocate funding towards liquid asset investment such as cash reserves and securities as an increase in competition renders bank liquidity creation activities less profitable. In addition, greater income diversification from interest-based towards fee-based in the midst of rising bank competition may

also lead to a moderation of bank liquidity creation. This is because fee-based products, except for off-balance sheet loan commitments, do not generally contribute to liquidity creation as they come in the forms of professional services.

6.3.3 Research objective three

The third research objective aims to examine the relationship between stock market liquidity and the liquidity creation of Malaysian commercial banks. The results indicate that, for all our stock market liquidity measures except turnover ratio, increased stock market liquidity helps to enhance liquidity creation by Malaysian commercial banks, which is consistent with the "market-bank liquidity enhancement" hypothesis. The positive relationship is stronger for on-balance sheet liquidity creation than off-balance sheet liquidity creation. Our finding based on stock market turnover ratio shows the contradictory relationship, which we believe to be doubtful because the turnover ratio has been widely criticised for not reflecting changes in the transaction costs on the market, especially during market volatility periods (Fleming, 2003; Karpoff, 1987; Lesmond, 2005; Rouetbi & Mamoghli, 2014).

We explain the positive relationship between stock market liquidity and bank liquidity creation in several ways. First, an increase in stock market liquidity allows investors to liquidate their share claims at ease with low transaction cost, which in turn diverts investors' liquidity demand away from banks to some degree. This permits banks to accept larger asset-liability mismatches, both liquidity and maturity, by channelling more liquidity from liquid reserves towards illiquid asset investments. Second, a liquid stock market reduces the equity and solvency costs of banks that have access to the stock market, either by being publicly listed or subsidiaries of listed financial holding companies, which incentivises the banks to originate additional loans to serve a greater scope of borrowers. Third, since about a quarter of the total market capitalisation and trading value of the Malaysia stock market involves foreign investors, an increase in stock market liquidity encourages external inflows of capital into Malaysia (BNM, 2016c). Thus, with a greater pool of deposits placed by domestic non-bank financial institutions and business firms with domestic commercial banks, more deposit funding is available for bank liquidity creation. Lastly, a liquid stock market motivates corporate firms to also seek bank guarantees and commitments that serve as a primary backup source of corporate financing, besides being motivated to raise capital directly from investors on the liquid market. This creates an opportunity for banks to create liquidity off the balance sheet.

6.3.4 Research objective four

Since the year 2001, the Malaysian authorities have been embarking on far-reaching reforms of the financial system led by four 10-year masterplans, namely the Financial Sector Masterplan (FSMP) and the parallel Capital Markets Masterplan (CMP) 1 for the period 2001 to 2010, the Financial Sector Blueprint and CMP 2 for the period 2011 to 2020 (BNM, 2001, 2011a; SCM, 2001, 2011). The reform initiatives are implemented gradually in phases, of which deregulation and liberalisation of the banking sector and stock market have been highly focused on since the second phases of FSMP and CMP1 (2004-2005), as part of initiatives to promote a competitive, diversified and more market-oriented financial system. Examples of banking deregulation and liberalisation measures are interest rate deregulation, relaxation of bank branching restrictions and issuance of new licenses to foreign and Islamic banks (BNM, 2001). In principle, the benefits of competition for efficiency, service quality provisions and innovation in banking are no different than in any other industry – which is probably the basis of the global trend towards greater competition in the banking industry (Allen & Gale, 2000; Vives, 2001). However, the banking industry has some specificities that may affect the desirability of competition in the industry, for example, a fragile financial position and information asymmetry (Vives, 2001). Since the Malaysian economy relies on its banking system to provide and, thus, to create liquidity for economy financing, if the liquidity creator role of the banks is weakened due to any inconsiderate policy implemented, there are catastrophic real effects on the economy. Hence, the fourth research objective aims to draw policy implications from the findings in order to assist the ongoing formulation, implementation and monitoring of policies related to bank competition and stock market development.

Commercial banks in Malaysia have been operating in a monopolistic competition environment, even before the FSMP implementation in 2001 (Abdul-Majid & Sufian, 2006). While supporting the monopolistic competition structure, the descriptive results based on the Lerner Index of pricing power of this study demonstrate that the average market power of individual Malaysian commercial banks has been receding since the year 2004, signalling the efficacy of deregulation and liberalisation initiatives implemented in the industry. The descriptive results also show that large Malaysian commercial banks possess significantly larger pricing power than small banks. The disparity in the pricing power appears to be more evident in the credit market than in the deposit market, owing to the competitive deposit market reported earlier in our study and the IMF (2014). The greater loan pricing of large banks than small banks can be explained through the types of market segments they serve because different market segments have different sources of competition. In Malaysia, large banks serve a wider scope of borrowers ranging from households and retail to business corporates, compared to corporate financing narrowly focused on by small banks. At the household and retail

banking levels, market contestability tends to be lower and locally-oriented owing to high entry barriers exerted by incumbent banks, such as reputations and the branch network, making room for large banks to exercise market power (Vives, 2001). On the other hand, the game in the business banking market tends to be competitively intense because business corporates have wider financing choices from banks, non-bank financial institutions and capital markets, both locally and globally (Vives, 2001). This explains why small banks that narrowly focus on corporate customers generally have relatively lower market power than large banks.

Indeed, with the presence of information asymmetry in banking, the regression results of our study show that the repression effect of an increase in bank competition on liquidity creation is apparent in the Malaysian commercial banking industry today, and this effect carries through to small banks. According to the fragility channel view, some degree of market power in banking is desirable to address the liquidity needs of economic agents such as borrowers and depositors (Petersen & Rajan, 1995; Dell'Ariccia & Marquez, 2004; Horvath et al., 2013, 2016). A bank with market power has greater incentive to invest in information acquisition about their customers and monitor them by granting loans and maintaining relationships with them, because the bank has greater ability to capture the customers and share in their wallets. This effect tends to reduce credit rationing to the public, which is especially valuable for informationally-opaque customers. Our study findings offer implications for policy makers that, some market power in banking is good, particularly when the economy is heavily reliant on the banking system for the liquidity supply and facilitation of the development of nascent industries and firms. Indeed, our additional results in Section 5.4.2 further indicate that the collective banking deregulation and liberalisation initiatives implemented in the Malaysian banking sector since the year 2004 has a negative effect on bank liquidity creation.

Besides, our regression results also indicate that an increase in competition has the traditional industrial organisation effect of compressing interest margins on both the asset and liability sides of banks and increasing liquidity creation undertakings to gain greater market share. This effect is, however, mild and evident only for large banks with substantial capacity for liquidity creation, for example, banks that have large market share and extensive branch networks throughout the country. When facing an increase in competition, large banks with high market power at household and retail banking levels, such as Maybank, are able to tolerate a lower interest spread to leverage their liquidity creation business in existing and new consumer markets (Lim, 2015). The findings imply that a competition policy has a role to play at the retail banking level and may be desirable in improving underserved customers' access to bank products and services. In this case, regulators should also monitor banks' pricing policies to ensure the policies adhere to the approved risk

appetite and risk management framework of the banks and industry. Such a 'risk-based pricing' strategy helps to thwart banks' unethical product mispricing through cross-subsidisation, protecting the welfare of bank customers (Vives, 2001). Owing to the size of large banks and the high social costs of failure, competition in the banking industry should be restricted when risk positions (for instance, the credit risk position) of banks are being compromised and there is failure to abide by the Basel Accord III on capital, leverage and liquidity requirements. Competition policies will certainly be exploited by large banks for excessive risk-taking undertakings because credit rationing to risky customers is reduced. While lower market power enhances liquidity creation by large banks, our findings suggest to policy makers that a higher level of market power can be more tolerated in banking than in other industries as competition is often associated with financial instability in banking (Berger et al, 2009; Fu et al., 2014; Kasman & Kasman, 2015; Vives, 2001).

In addition, the different effect of bank competition on liquidity creation between small and large banks also raises interesting policy implications. Competition has reduced small banks to a process of value differentiation in the liquidity creation role. This implies that small banks that do not create liquidity when encountering a rise in competition are finding themselves increasingly marginalised from the mainstream of liquidity creation activity dominated by large banks. Without greater scale, small banks' competitive position is not as compelling as bank customers seek financial solutions in a safe and steady name with a sustainable business in Malaysia. Hence, it is important for small banks to build scale, implement appropriate technological and value-added solutions and adapt their branding strategies and business models to weather the adverse impact of competition on their liquidity creation role in the economy, unless their shareholders are in for a long game of low margins to pursue other meaningful business objectives. While acknowledging the development of a competitive banking sector is a confluence of economic, technological and regulatory factors as well as the uprising Islamic banking in the context of Malaysian banking sector, this study suggests greater regulatory leeway and protection for small banks when designing banking competition policy for the highly concentrated Malaysian banking sector. This can be helpful in providing headroom for small banks to strengthen their competitiveness and in deterring heavyweight banks from abusing their market dominance in a way that smaller banks cannot. For instance, given the fact that small banks in Malaysia target niche markets and offer personalised products and services, their existence in the market can create a competition of service quality which prompts large banks to enhance their service quality. An inconsiderate competition policy can lead to an imbalanced development of the banking industry in the long term, as the liquidity creation function of small banks may not be sustainable in the competitive financial landscape.

In terms of the stock market liquidity, the descriptive results do not show any evident improvement of the market liquidity in Malaysia over the short time span from 2001 to 2013. The effectiveness of the reform measures on stock market liquidity requires a longer-term surveillance because the market has had a long history of illiquidity compared to other ASEAN peer averages and the world average. Besides, the correlation analysis shows that the turnover ratio, which is commonly used by regulators, is a weak proxy for the stock market liquidity because it does not have significant correlations with quoted bid-ask spread and Amihud's illiquidity ratio which measure the transaction cost and the breadth and depth of the stock market, respectively. The regression results using turnover ratio also show contradictory results to those using alternative stock market liquidity measures. As has been reported by previous studies, turnover ratio measures the trading activity on the market, but it does not necessarily reflect changes in the trading costs that correlate with stock price volatility which can impede the market liquidity (Fleming, 2003; French & Roll, 1985; Lesmond, 2005; Rouetbi & Mamoghli, 2014). It is, thus, important for policy makers to look at a broad set of indicators when gauging stock market liquidity conditions, instead of relying solely on the market turnover ratio.

Overall, the regression analyses show that an increase in stock market liquidity does improve liquidity creation by commercial banks in Malaysia. This finding implies that further policy initiatives that address the structural impediments on market liquidity and liberalise market access for intermediaries, issuers and investors are encouraged. This is because a liquid stock market does not only facilitate more effective mobilisation and allocation of funds through the role of the stock market, but also stimulates liquidity creation undertakings of banks for a wider scope of customers in catering for the nation's growing financing needs.

6.4 Limitations of the study

There are several limitations in our study that may make the results less generalizable. The first limitation lies in the liquidity creation measures that provide only rough approximations of liquidity created by banks for the economy because the measures rely on the classification of banks' balance sheet items into the "liquid", "semiliquid" and "illiquid" baskets. For example, the liquidity creation measures based on the maturity classification approach are confined to the available maturity information of balance sheet items. This present study is able to classify loans maturing in less than one year as semi-liquid assets, loans maturing over one year as illiquid assets, term deposits maturing within six months as liquid liabilities, term deposits maturing between six months to one year as semiliquid liabilities and term deposits maturing greater than one year as illiquid liabilities. If

a more detailed maturity breakdown of these items was available, then the magnitude of liquidity creation would be smaller and a closer approximation to that computed using the "category" classification.

This study also relies on daily stock trading data to compute stock market liquidity measures. We do not have access to intraday stock trading data, such as effective bid-ask spread and commission fees, to calculate the actual transaction cost that implies the stock market liquidity because the transaction cost varies with depth (quote size and trade size), timing, counterparties and market-specific peculiarities. Measuring stock market liquidity and transaction cost is never simple. Therefore, this study employs numerous alternative measures to evaluate the market liquidity.

Owing to the small sample size employed in this study, the fixed-effect estimator is the best estimation method available for us to examine the relationships of interest and deal with possible endogeneity issues. We were not able to systematically examine the dynamic process of the empirical relationships and address the ensuing endogeneity issues by using the more restrictive dynamic Generalised Method of Moments (GMM) that fits best with a short and wide panel dataset. The GMM estimator may not yield consistent and efficient estimates because the number of internally-generated instruments tends to increase with the number of time periods of our panel dataset and, as a result, the large instrument collection overfits endogenous variables and weakens the Hansen test of the instruments' joint validity (Roodman, 2009). Nonetheless, the Durbin-Wu-Hausman endogeneity tests in the context of fixed-effects IV estimation do not reject the exogeneity of the regressors of interest (bank competition and stock market liquidity). It is, thus, plausible to conclude that the strict regressor exogeneity assumption of the fixed-effect estimator is met and that the fixed-effect estimator is consistent.

6.5 Future research

This study offers several future research avenues. Since the Islamic banking industry is emerging in Malaysia and competes with commercial banks for liquidity creation activities in the same market, future research can extend this present study by also examining the effect of competition on the liquidity creation of Islamic banks and compare it with our findings for commercial banks. It will be interesting to see how conventional and Sharia-compliant business models for banking may exert different effects on the empirical relationship.

While the results bear significant policy implications, we leave future researchers with various possible analyses with respects to the deregulation and liberalisation policies that have been implemented in the banking sector and stock market over the past decade to assess the effects of these policies on bank liquidity creation. Specific policies that can be explored include cuts in the stock market transaction costs like clearing fee, trading fee and Securities Commission levy fee in 2001, liberalisation of stockbroking commission rates in 2001 and change in the tick size regime in 2009. It would also be an interesting reseach avenue to examine the influences on bank liquidity creation after the implementation of the Basel Accord III standards for liquidity coverage ratio and net stable funding ratio in Malaysia. This is because the Basel standards may present a greater hurdle for bank liquidity creation. Our findings, which shed light on the influences on bank liquidity creation in Malaysia for the 2001-2013 period (pre-Basel III implementation), offer a valuable reference for future studies subsequent to the period.

Lastly, we recommend that future research use survey data to obtain insightful information about the impact of bank competition and stock market liquidity on bank liquidity creation in Malaysia. Specifically, future research can explore both the banks' and the corporate and retail customers' perspectives about how changes in competition and stock market liquidity have affected bank product pricing, the value of the bank-customer relationship for both banks and customers and the supply and demand for bank products and services.

Appendix A

The List of the Commercial Banks Used in This Study

Table A.1 List of the commercial banks used in this study

No.	Bank name	Size classification
1	Affin Bank Berhad	Large
2	Alliance Bank Malaysia Berhad	Large
3	AmBank (M) Berhad	Large
4	Bangkok Bank Berhad	Small
5	Bank of America Malaysia Berhad	Small
6	Bank of China (Malaysia) Berhad	Small
7	Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad	Small
8	BNP Paribas Malaysia Berhad	Small
9	CIMB Bank Berhad	Large
10	Citibank Berhad	Large
11	Deutsche Bank (Malaysia) Berhad	Small
12	Eon bank berhad	Large
13	Hong Leong Bank Berhad	Large
14	HSBC Bank Malaysia Berhad	Large
15	Industrial and Commercial Bank of China (Malaysia) Berhad	Small
16	J.P. Morgan Chase Bank Berhad	Small
17	Malayan Banking Berhad	Large
18	Mizuho Corporate Bank (Malaysia) Berhad	Small
19	OCBC Bank (Malaysia) Berhad	Large
20	Public Bank Berhad	Large
21	RHB Bank Berhad	Large
22	Southern Bank Berhad	Large
23	Standard Chartered Bank Malaysia Berhad	Large
24	Sumitomo Mitsui Banking Corporation Malaysia Berhad	Small
25	The Bank of Nova Scotia Berhad	Small
26	The Royal Bank of Scotland Berhad	Small
27	United Overseas Bank (Malaysia) Berhad	Large

Note: In this appendix, banks that usually hold total assets of up to MYR20 billion are classified as small banks, and banks that usually hold total assets exceeding MYR20 billion are classified as large banks.

References

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2009). The impact of Islamic banking on the cost efficiency and productivity change of Malaysian commercial banks. *Applied Economics, 43*(16), 2033-2054. doi:10.1080/00036840902984381

Abdul-Majid, M. Z., & Sufian, F. (2006). Consolidation and Competition in Emerging Market: An Empirical Test for Malaysian Banking Industry. *Economic Change and Restructuring, 39*(1-2), 105-124. doi:http://dx.doi.org/10.1007/s10644-007-9022-4

Acharya, V. V., & Pedersen, L. H. (2005). Asset pricing with liquidity risk. *Journal of Financial Economics, 77*(2), 375-410. doi:http://dx.doi.org/10.1016/j.jfineco.2004.06.007

Adjei-Frimpong, K., Gan, C., & Hu, B. (2015). Competition in the banking industry: Empirical evidence from Ghana. *Journal of Banking Regulation*. doi:10.1057/jbr.2014.24

Akhavein, J., Frame, W. S., & White, L. J. (2005). The Diffusion of Financial Innovations: An Examination of the Adoption of Small Business Credit Scoring by Large Banking Organizations. *The Journal of Business, 78*(2), 577-596. doi:10.1086/427639

Al-Khouri, R. (2012). Bank Characteristics and Liquidity Transformation: The Case of GCC Banks. *International Journal of Economics and Finance, 4*(12), 114-120.

Allen, F., & Gale, D. (2000). *Comparing financial systems*. London: The MIT Press.

Amidu, M., & Wolfe, S. (2013). Does bank competition and diversification lead to greater stability? Evidence from emerging markets. *Review of Development Finance, 3*(3), 152-166. doi:http://dx.doi.org/10.1016/j.rdf.2013.08.002

Amihud, Y. (2002). Illiquidity and stock returns: cross-section and time-series effects. *Journal of Financial Markets, 5*(1), 31-56. doi:http://dx.doi.org/10.1016/S1386-4181(01)00024-6

Angelini, P., & Cetorelli, N. (2003). The effects of regulatory reform on competition in the banking industry. *Journal of Money, Credit, and Banking, 35*(5), 663-684.

Asteriou, D., & Siriopoulos, C. (2000). The Role of Political Instability in Stock Market Development and Economic Growth: The Case of Greece. *Economic Notes, 29*(3), 355-374. doi:10.1111/1468-0300.00037

Bank for International Settlements. (n.d.). International regulatory framework for banks (Basel III). Retrieved from http://www.bis.org/bcbs/basel3.htm

Beck, T., Demirguc-Kunt, A., & Maksimovic, V. (2004). Bank Competition and Access to Finance: International Evidence. *Journal of Money, Credit, and Banking, 36*(3), 627-648.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2007). Liquidity and Expected Returns: Lessons from Emerging Markets. *Review of Financial Studies, 20*(6), 1783-1831. doi:10.1093/rfs/hhm030

Bencivenga, V. R., Smith, B. D., & Starr, R. M. (1995). Transactions Costs, Technological Choice, and Endogenous Growth. *Journal of Economic Theory, 67*(1), 153-177. doi:http://dx.doi.org/10.1006/jeth.1995.1069

Benston, G. J., Hanweck, G. A., & Humphrey, D. B. (1982). Scale Economies in Banking: A Restructuring and Reassessment. *Journal of Money, Credit and Banking, 14*(4), 435-456. doi:10.2307/1991654

Berger, A. N. (2014). Small business lending by banks. In A. N. Berger, P. Molyneux, & J. O. S. Wilson (Eds.), *The Oxford Handbook of Banking* (2nd ed.). Oxford: Oxford University Press.

Berger, A. N., & Black, L. K. (2011). Bank size, lending technologies, and small business finance. *Journal of Banking & Finance, 35*(3), 724-735. doi:http://dx.doi.org/10.1016/j.jbankfin.2010.09.004

Berger, A. N., & Bouwman, C. H. S. (2009). Bank Liquidity Creation. *Review of Financial Studies, 22*(9), 3779-3837. doi:10.1093/rfs/hhn104

Berger, A. N., Bouwman, C.H.S. (2012). Bank Liquidity Creation, Monetary Policy, and Financial Crises. Available at SSRN: http://dx.doi.org/10.2139/ssrn.1952728

Berger, A. N., & Bouwman, C. H. S. (2016). *Bank liquidity creation and financial crises*. Oxford, UK.: Elsevier Inc.

Berger, A. N., & Udell, G. F. (1995). Relationship lending and lines of credit in small firm finance. *The Journal of Business, 68*(3), 351-381.

Berger, A. N., & Udell, G. F. (2006). A more complete conceptual framework for SME finance. *Journal of Banking & Finance, 30*(11), 2945-2966. doi:http://dx.doi.org/10.1016/j.jbankfin.2006.05.008

Berger, A. N., & Hannan, T. H. (1989). The Price-Concentration Relationship in Banking. *The Review of Economics and Statistics, 71*(2), 291-299. doi:10.2307/1926975

Berger, A. N., Frame, W. S., & Miller, N. H. (2005a). Credit Scoring and the Availability, Price, and Risk of Small Business Credit. *Journal of Money, Credit and Banking, 37*(2), 191-222. doi:10.2307/3838924

Berger, A., Klapper, L., & Turk-Ariss, R. (2009). Bank Competition and Financial Stability. *Journal of Financial Services Research, 35*(2), 99-118. doi:10.1007/s10693-008-0050-7

Berger, A. N., Klapper, L. F., & Udell, G. F. (2001). The ability of banks to lend to informationally opaque small businesses. *Journal of Banking & Finance, 25*(12), 2127-2167. doi:http://dx.doi.org/10.1016/S0378-4266(01)00189-3

Berger, A. N., Rosen, R. J., & Udell, G. F. (2007). Does market size structure affect competition? The case of small business lending. *Journal of Banking & Finance, 31*(1), 11-33. doi:http://dx.doi.org/10.1016/j.jbankfin.2005.10.010

Berger, A. N., Bouwman, C. H. S., Kick, T., Schaeck, K. (2010). Bank liquidity creation and risk taking during distress. *Discussion Paper Series 2: Banking and Financial Studies, 05/2010*.

Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., & Stein, J. C. (2005b). Does function follow organizational form? Evidence from the lending practices of large and small banks. *Journal of Financial Economics, 76*(2), 237-269. doi:http://dx.doi.org/10.1016/j.jfineco.2004.06.003

Bessembinder, H., & Venkataraman, K. (2010). Bid–Ask Spreads. *Encyclopedia of Quantitative Finance*: John Wiley & Sons, Ltd.

BNM. (1998a). *Liquidity framework*. Kuala Lumpur: BNM. Retrieved from http://www.bnm.gov.my/guidelines/01_banking/04_prudential_stds/02_liquidity.pdf.

BNM. (1998b). Reduction of the 3-month intervention rate and the introduction of a New Liquidity Framework Retrieved from http://www.bnm.gov.my/?ch=en_press&pg=en_press_all&ac=477&lang=en

BNM. (2001). *Financial sector masterplan 2001 - 2010*. Retrieved from http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_blueprint&ac=19&lang=en&eId=box1

BNM. (2005). *Bank Negara Malaysia annual report 2004*. Retrieved from http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_bnmar&eId=box2&lang=en&yr=2004

BNM. (2006). Bank Negara Malaysia annual report 2005. Retrieved from http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_bnmar&eId=box2&lang=en&yr=2005

BNM. (2007). Islamic banking. Retrieved from http://www.bnm.gov.my/index.php?ch=174&pg=467&ac=367

BNM. (2009). *Financial Stability and Payment Systems Report 2008*. Retrieved from http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_fsps&eId=box2&lang=en&yr=2008

BNM. (2011a). *Financial sector blueprint 2011 - 2020*. Retrieved from http://www.bnm.gov.my/index.php?ch=en_publication_catalogue&pg=en_publication_blueprint&ac=7&lang=en&eId=box1

BNM. (2011b). *Statutory reserve requirement*. Kuala Lumpur: BNM. Retrieved from http://www.bnm.gov.my/guidelines/01_banking/04_prudential_stds/01_statutory_20110708.pdf.

BNM. (2012). Implementation of Basel III. Retrieved from http://www.bnm.gov.my/guidelines/01_banking/01_capital_adequacy/12_nt_007_25.pdf

BNM. (2014a). About the bank. Retrieved from http://www.bnm.gov.my/index.php?ch=en_about&pg=en_intro&ac=641&tpt=bnm_2011&lang=en

BNM. (2014b). Credit Bureau. Retrieved from http://creditbureau.bnm.gov.my/creditabout.html

BNM. (2015). *Administered legislation*. Kuala Lumpur: BNM. Retrieved from http://www.bnm.gov.my/index.php?ch=en_legislation&tpt=bnm_2011&lang=en.

BNM. (2016a). *Glossary*. Kuala Lumpur: BNM. Retrieved from http://www.bnm.gov.my/files/publication/msb/2016/3/x_en.pdf.

BNM. (2016b). *BNM's Statutory Reserve Requirement (SRR)*. Kuala Lumpur: BNM Retrieved from http://www.bnm.gov.my/guidelines/01_banking/04_prudential_stds/01_statutory_20160127.pdf.

BNM. (2016c). *Annual report 2015*. Retrieved from http://www.bnm.gov.my/files/publication/ar/en/2015/ar2015_book.pdf

Boone, J. (2008). A new way to measure competition. *The Economic Journal, 118*(531), 1245-1261. doi:10.1111/j.1468-0297.2008.02168.x

Boot, A. W. A., & Thakor, A. V. (2000). Can relationship banking survive competition? *The Journal of Finance, 55*(2), 679-713. doi:10.1111/0022-1082.00223

Borenstein, S., & Bushnell, J. (1999). An empirical analysis of the potential for market power in California's electricity industry. *The Journal of Industrial Economics, 47*(3), 285-323.

Borio, C. (2000). Market liquidity and stress: selected issues and policy implications. *BIS Quarterly Review, November* (pp. 38-51).

Brickley, J. A., Linck, J. S., & Smith Jr, C. W. (2003). Boundaries of the firm: evidence from the banking industry. *Journal of Financial Economics, 70*(3), 351-383. doi:http://dx.doi.org/10.1016/S0304-405X(03)00170-3

Bryant, J. (1980). A model of reserves, bank runs, and deposit insurance. *Journal of Banking & Finance, 4*(4), 335-344. doi:http://dx.doi.org/10.1016/0378-4266(80)90012-6

Bursa Malaysia. (2006). *Annual report 2006*. Retrieved from http://bursa.listedcompany.com/misc/ar2006.pdf

Bursa Malaysia. (2009). *Annual report 2009*. Retrieved from http://bursa.listedcompany.com/misc/ar2009.pdf

Bursa Malaysia. (2013). *Annual report 2013*. Retrieved from http://bursa.listedcompany.com/misc/ar2013.pdf

Bursa Malaysia. (2015a). *Annual report 2015*. Retrieved from http://bursa.listedcompany.com/CDCBE68B-49FC-428F-BACB-B650B976305C/FinalDownload/DownloadId-713B1D8E8BFB2761C04FE7BAC371CD11/CDCBE68B-49FC-428F-BACB-B650B976305C/misc/ar2015.pdf

Bursa Malaysia. (2015b). *Trading*. Retrieved from http://www.bursamalaysia.com/market/securities/equities/trading/trading-procedures

Bursa Malaysia. (2015c). *FTSE Bursa Malaysia Indices*. Retrieved from http://www.bursamalaysia.com/market/products-services/indices/ftse-bursa-malaysia-indices/overview/

Bursa Malaysia. (2015d). Listing statistics. Retrieved from http://www.bursamalaysia.com/market/listed-companies/initial-public-offerings/listing-statistics/

Bursa Malaysia. (2015e). *Listing on Bursa Malaysia*. Retrieved from http://www.bursamalaysia.com/market/listed-companies/listing-on-bursa-malaysia/your-listing-destination/

Bursa Malaysia. (2016). Overview. Retrieved from http://www.bursamalaysia.com/corporate/about-us/overview/

Butler, A. W., Grullon, G., & Weston, J. P. (2005). Stock Market Liquidity and the Cost of Issuing Equity. *Journal of Financial and Quantitative Analysis, 40*(02), 331-348. doi:doi:10.1017/S0022109000002337

Calomiris, C. W., & Kahn, C. M. (1991). The role of demandable debt in structuring optimal banking arrangements. *The American Economic Review, 81*(3), 497-513. doi:10.2307/2006515

Carbó-Valverde, S., Rodríguez-Fernández, F., & Udell, G. F. (2009). Bank market power and sme financing constraints. *Review of Finance, 13*(2), 309-340. doi:10.1093/rof/rfp003

Carletti, E., & Leonello, A. (2011). Credit market competition and liquidity crises. *European University Institute Working Paper, 2012/14*.

Carletti, E., Hartmann, P., & Spagnolo, G. (2007). Bank mergers, competition, and liquidity. *Journal of Money, Credit and Banking, 39*(5), 1067-1105. doi:10.2307/4494287

Cetorelli, N. (2001). Does bank concentration lead to concentration in industrial sectors? *FRB of Chicago Working Paper No. 2001-01*.

Cetorelli, N. (2004). Real effects of bank competition. *Journal of Money, Credit and Banking, 36*(3), 543-558. doi:10.2307/3838952

Cetorelli, N., & Gambera, M. (2001). Banking market structure, financial dependence and growth: international evidence from industry Data. *The Journal of Finance, 56*(2), 617-648. doi:10.1111/0022-1082.00339

Chamberlin, E. (1969). *The theory of monopolistic competition; a reorientation of the theory of value*. Cambridge, Mass.: Harvard University Press.

Charoenwong, C., Chong, B. S., & Yang, Y. C. (2014). Asset liquidity and stock liquidity: international evidence. *Journal of Business Finance & Accounting, 41*(3-4), 435-468. doi:10.1111/jbfa.12052

Chatterjee, U. K. (2015). Bank liquidity creation and asset market liquidity. *Journal of Financial Stability, 18*, 139-153. doi:http://dx.doi.org/10.1016/j.jfs.2015.03.006

Chong, T. T.-L., Lu, L., & Ongena, S. (2013). Does banking competition alleviate or worsen credit constraints faced by small- and medium-sized enterprises? Evidence from China. *Journal of Banking & Finance, 37*(9), 3412-3424. doi:http://dx.doi.org/10.1016/j.jbankfin.2013.05.006

Chordia, T., Roll, R., & Subrahmanyam, A. (2001). Market liquidity and trading activity. *The Journal of Finance, 56*(2), 501-530. doi:10.2307/222572

Chordia, T., Sarkar, A., & Subrahmanyam, A. (2005). An empirical analysis of stock and bond market liquidity. *The Review of Financial Studies, 18*(1), 85-129. doi:10.2307/3598068

Choudhry, M. (2010). Measuring bond market liquidity: devising a composite aggregate liquidity score. *Applied Financial Economics, 20*(12), 955-973. doi:10.1080/09603101003724281

Citibank Berhad. (2014). *Annual report 2013*. Retrieved from https://www.citibank.com.my/english/docs/pdf/citibank-financial-statement/Financial_Statements_Citibank_Berhad_Q4_2013.pdf

Claessens, S., & Laeven, L. (2004). What drives bank competition? Some international evidence. *Journal of Money, Credit and Banking, 36*(3), 563-583. doi:10.2307/3838954

Claessens, S., & Laeven, L. (2005). Financial dependence, banking sector competition, and economic growth. *Journal of the European Economic Association, 3*(1), 179-207. doi:10.1162/1542476053295322

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis* (2nd. ed.). NY: Springer Science & Business Media Inc.

Cole, R. A. (1998). The importance of relationships to the availability of credit. *Journal of Banking & Finance, 22*(6–8), 959-977. doi:http://dx.doi.org/10.1016/S0378-4266(98)00007-7

Cole, R. A., Goldberg, L. G., & White, L. J. (2004). Cookie cutter vs. character: the micro structure of small business lending by large and small banks. *The Journal of Financial and Quantitative Analysis, 39*(2), 227-251. doi:10.2307/30031854

Committee on the Global Financial System. (1999). Market liquidity: research findings and selected policy implications: Bank for International Settlements.

Connor, J. M., & Peterson, E. B. (1992). Market-structure determinants of national brand-private label price differences of manufactured food products. *The Journal of Industrial Economics, 40*(2), 157-171. doi:10.2307/2950507

Corvoisier, S., & Gropp, R. (2002). Bank concentration and retail interest rates. *Journal of Banking & Finance, 26*(11), 2155-2189. doi:http://dx.doi.org/10.1016/S0378-4266(02)00204-2

Credit Guarantee Corporation Malaysia (CGC). (2014). Overview. Retrieved from https://www.cgc.com.my/overview/

Cyrnak, A. W., & Hannan, T. H. (1999). Is the cluster still valid in defining banking markets? Evidence from a new data source. *Antitrust Bulletin, 44*(2), 313-331.

de Guevara, J. F., & Maudos, J. (2011). Banking competition and economic growth: cross-country evidence. *The European Journal of Finance, 17*(8), 739-764. doi:10.1080/1351847X.2011.554300

de Guevara, J. F., Maudos, J., & Pérez, F. (2005). Market power in European banking sectors. *Journal of Financial Services Research, 27*(2), 109-137.

Deep, A., & Schaefer, G. K. (2004). Are banks liquidity transformers? *KSG Working Paper No. RWP04-022*. Retrieved from doi:http://dx.doi.org/10.2139/ssrn.556289

Degryse, H., & Ongena, S. (2008). CHAPTER 15 - Competition and regulation in the banking sector: a review of the empirical evidence on the sources of bank rents. *Handbook of Financial Intermediation and Banking* (pp. 483-554). San Diego: Elsevier.

Degryse, H., & Van Cayseele, P. (2000). Relationship lending within a bank-based system: Evidence from European small business data. *Journal of Financial Intermediation, 9*(1), 90-109. doi:http://dx.doi.org/10.1006/jfin.1999.0278

Dell'Ariccia, G. (2001). Asymmetric information and the structure of the banking industry. *European Economic Review, 45*(10), 1957-1980. doi:http://dx.doi.org/10.1016/S0014-2921(00)00085-4

Dell'Ariccia, G., & Marquez, R. (2004). Information and bank credit allocation. *Journal of Financial Economics, 72*(1), 185-214. doi:http://dx.doi.org/10.1016/S0304-405X(03)00210-1

Deloitte Touche Tohmatsu Limited. (2015). *Malaysia Taxation and Investment 2015*. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-malaysiaguide-2015.pdf

Demirgüç-Kunt, A., & Levine, R. (1996a). Stock markets, corporate finance, and economic growth: an overview. *The World Bank Economic Review, 10*(2), 223-239. doi:10.2307/3990061

Demirgüç-Kunt, A., & Levine, R. (1996b). Stock market development and financial intermediaries: stylized facts. *The World Bank Economic Review, 10*(2), 291-321. doi:10.2307/3990064

Demirgüç-Kunt, A., & Maksimovic, V. (1996). Stock market development and financing choices of firms. *The World Bank Economic Review, 10*(2), 341-369.

Demirguc-Kunt, A., & Martinez Peria, M. S. (2010). A framework for analyzing competition in the banking sector: an application to the case of Jordan. Policy Research Working Paper No. 5499. The World Bank. Washington, D.C. Retrieved from http://documents.worldbank.org/curated/en/349041468063241288/A-framework-for-analyzing-competition-in-the-banking-sector-an-application-to-the-case-of-Jordan

Dey, M. K., & Flaherty, S. (2005). Stock exchange liquidity, bank credit, and economic growth. Working paper. Department of Accounting and Finance. Morgan State University, Department of Accounting and Finance. Maryland. Retrieved from http://web.econ.ku.dk/fru/conference/Programme/Sunday/F1/Dey_2_banktstock-mar05.pdf

DeYoung, R., Hunter, W., & Udell, G. (2004). The past, present, and probable future for community banks. *Journal of Financial Services Research, 25*(2-3), 85-133. doi:10.1023/B:FINA.0000020656.65653.79

Diamond, D. W. (1997). Liquidity, banks, and markets. *Journal of Political Economy, 105*(5), 928-956. doi:10.1086/262099

Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *The Journal of Political Economy, 91*(3), 401-419.

Diamond, D. W., & Rajan, R. G. (2001). Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking. *Journal of Political Economy, 109*(2), 287-327. doi:10.1086/319552

Dinc, I. S. (2000). Bank reputation, bank commitment, and the effects of competition in credit markets. *The Review of Financial Studies, 13*(3), 781-812.

Dinç, I. S. (2005). Politicians and banks: Political influences on government-owned banks in emerging markets. *Journal of Financial Economics, 77*(2), 453-479. doi:http://dx.doi.org/10.1016/j.jfineco.2004.06.011

Dutta, J., & Kapur, S. (1993). *Liquidity and financial intermediation CORE discussion paper 9330*. Louvain: Center for Operations Research and Econometrics.

ECB. (2012). Global liquidity: concepts, measurements and implications from a monetary policy perspective. *Monthly Bulletin October 2012*.

Economic Planning Unit. (2013). *Vision 2020, 1991-2020*. Retrieved from http://www.epu.gov.my/en/wawasan-2020-1991-2020

El-Gamal, M. A., & Inanoglu, H. (2005). Inefficiency and heterogeneity in Turkish banking: 1990-2000. *Journal of Applied Econometrics, 20*(5), 641-664.

Fischer, K. H. (2000). Acquisition of information in loan markets and bank market power - An empirical investigation. Available at SSRN: http://dx.doi.org/10.2139/ssrn.240921

Fischer, K. H., & Pfeil, C. (2004). Regulation and competition in German banking: an assessment. *CFS Working Paper No. 2003/19*.

Fleming, M. J. (2003). Measuring treasury market liquidity. *Federal Reserve Bank of New York Economic Policy Review, 9,* 83-108.

Frame, W. S., Srinivasan, A., & Woosley, L. (2001). The Effect of Credit Scoring on Small-Business Lending. *Journal of Money, Credit and Banking, 33*(3), 813-825. doi:10.2307/2673896

Freixas, X., & Rochet, J.-C. (2007). *Microeconomics of banking* (2nd ed.). Massachusetts, US.: MIT Press.

French, K. R., & Roll, R. (1986). Stock return variances: The arrival of information and the reaction of traders. *Journal of Financial Economics, 17*(1), 5-26. doi:http://dx.doi.org/10.1016/0304-405X(86)90004-8

FTSE. (2015). *FTSE Bursa Malaysia Index Series*. Retrieved from http://www.ftse.com/products/indices/bursa-malaysia

Fu, X., Lin, Y., & Molyneux, P. (2014). Bank competition and financial stability in Asia Pacific. *Journal of Banking & Finance, 38*, 64-77. doi:http://dx.doi.org/10.1016/j.jbankfin.2013.09.012

Fulghieri, P., & Rovelli, R. (1998). *Capital markets, financial intermediaries and liquidity supply* (Vol. 98/19/FIN). Fontainebleau: ISEAD, Finance department.

Fungacova, Z., & Weill, L. (2012). Bank Liquidity Creation in Russia. *Eurasian Geography and Economics, 53*(2), 285-299. doi:10.2747/1539-7216.53.2.285

Fungácová, Z., Ariss, R. T., & Weill, L. (2013b). Does excessive liquidity creation trigger bank failures? *BOFIT Discussion Papers, 2013*(2), 4-34.

Furst, K., Lang, W. W., & Nolle, D. E. (2002). Internet banking. *Journal of Financial Services Research, 22*(1,2), 95-117.

Gabrielsen, A., Marzo, M., & Zagaglia, P. (2011). *Measuring market liquidity: An introductory survey*. Cass Business School. London. Retrieved from http://arxiv.org/abs/1112.6169

Goyenko, R. Y., Holden, C. W., & Trzcinka, C. A. (2009). Do liquidity measures measure liquidity? *Journal of Financial Economics, 92*(2), 153-181. doi:http://dx.doi.org/10.1016/j.jfineco.2008.06.002

Guzman, M. G. (2000). Bank Structure, Capital Accumulation and Growth: A Simple Macroeconomic Model. *Economic Theory, 16*(2), 421-455. doi:10.2307/25055334

Hackethal, A., Rauch, C., Steffen, S., & Tyrell, M. (2010). *Determinants of bank liquidity creation*. Retrieved from http://www.researchgate.net/publication/228293023_Determinants_of_Bank_Liquidity_Creation

Hainz, C., Weill, L., & Godlewski, C. J. (2013). Bank Competition and Collateral: Theory and Evidence. *Journal of Financial Services Research, 44*(2), 131-148. doi:http://dx.doi.org/10.1007/s10693-012-0141-3

Hannan, T. H. (1991). Bank Commercial Loan Markets and the Role of Market Structure: Evidence from Surveys of Commercial Lending. *Journal of Banking & Finance, 15*(1), 133-149.

Hannan, T. H. (1997). Market share inequality, the number of competitors, and the hhi: an examination of bank pricing. *Review of Industrial Organization, 12*(1), 23-35. doi:http://dx.doi.org/10.1023/A:1007744119377

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics*, *93*(2), 345-368. doi:https://doi.org/10.1016/S0304-4076(99)00025-1

Haubrich, J. G., & King, R. G. (1990). Banking and insurance. *Journal of Monetary Economics, 26*(3), 361-386. doi:http://dx.doi.org/10.1016/0304-3932(90)90003-M

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271. doi:10.2307/1913827

Hauswald, R., & Marquez, R. (2006). Competition and Strategic Information Acquisition in Credit Markets. The Review of Financial Studies, 19(3), 967-1000. doi:https://doi.org/10.1093/rfs/hhj021

Heitfield, E., & Prager, R. (2004). The geographic scope of retail deposit markets. *Journal of Financial Services Research, 25*(1), 37-55. doi:10.1023/B:FINA.0000008664.47740.a5

Holmstrom, B., & Tirole, J. (1998). Private and public supply of liquidity. *Journal of Political Economy, 106*(1), 1-40. doi:10.1086/250001

Horvath, R., Seidler, J., & Weill, L. (2013). How bank competition influence liquidity creation. *BOFIT Discussion Papers, 2013*(16), 1-22.

Horváth, R., Seidler, J., & Weill, L. (2014). Bank capital and liquidity creation: granger-causality evidence. *Journal of Financial Services Research, 45*(3), 341-361. doi:http://dx.doi.org/10.1007/s10693-013-0164-4

Horvath, R., Seidler, J., & Weill, L. (2016). How bank competition influences liquidity creation. *Economic Modelling, 52, Part A*, 155-161. doi: http://dx.doi.org/10.1016/j.econmod.2014.11.032

Huang, R. D., & Stoll, H. R. (1996). Dealer versus auction markets: A paired comparison of execution costs on NASDAQ and the NYSE. *Journal of Financial Economics, 41*(3), 313-357. doi:http://dx.doi.org/10.1016/0304-405X(95)00867-E

IMF. (2014). *Malaysia Financial sector performance, vulnerabilities and derivatives—technical note.* IMF Country Report No. 14/98. IMF. Washington D.C.

Jacklin, C. (1987). Demand deposits, trading restrictions, and risk sharing. In E. C. Prescott, & N. Wallace (Ed.), *Contractual Arrangements for Intertemporal Trade* (pp. 27-47). Minneapolis: University of Minnesota.

Jayaratne, J., & Wolken, J. (1999). How important are small banks to small business lending?: New evidence from a survey of small firms. *Journal of Banking & Finance, 23*(2–4), 427-458. doi:http://dx.doi.org/10.1016/S0378-4266(98)00085-5

Jeong, H. K., & Joh, S.W. (2010). Risk taking of "too big to fail" banks in a concentrated market: Evidence from surviving banks after a financial crisis.

Jiang, L., Levine, R., & Lin, C. (2016). Competition and bank liquidity creation. *Working paper*. Hong Kong: Lingnan University.

Joh, S. W., & Kim, J. (2012). *Does competition affect the role of banks as liquidity providers*. Seoul National University. Retrieved from http://www.apjfs.org/conference/2012/cafmFile/5-2.pdf

Kang, W., & Zhang, H. (2014). Measuring liquidity in emerging markets. *Pacific-Basin Finance Journal, 27*(0), 49-71. doi:http://dx.doi.org/10.1016/j.pacfin.2014.02.001

Karpoff, J. M. (1987). The Relation Between Price Changes and Trading Volume: A Survey. *The Journal of Financial and Quantitative Analysis, 22*(1), 109-126. doi:10.2307/2330874

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-Taking. *The Journal of Finance, 57*(1), 33-73. doi:10.1111/1540-6261.00415

Kasman, S., & Kasman, A. (2015). Bank competition, concentration and financial stability in the Turkish banking industry. *Economic Systems, 39*(3), 502-517. doi:http://dx.doi.org/10.1016/j.ecosys.2014.12.003

Keeley, M. C. (1990). Deposit Insurance, Risk, and Market Power in Banking. *The American Economic Review, 80*(5), 1183-1200. doi:10.2307/2006769

Klein, M. A. (1971). A Theory of the Banking Firm. *Journal of Money, Credit and Banking, 3*(2), 205-218. doi:10.2307/1991279

Kyle, A. S. (1985). Continuous Auctions and Insider Trading. *Econometrica, 53*(6), 1315-1335. doi:10.2307/1913210

Lei, A. C. H., & Song, Z. (2013). Liquidity creation and bank capital structure in China. *Global Finance Journal, 24*(3), 188-202. doi:http://dx.doi.org/10.1016/j.gfj.2013.10.004

Lerner, A. P. (1934). The concept of monopoly and the measurement of monopoly power. *The Review of Economic Studies, 1*(3), 157-175. doi:10.2307/2967480

Lesmond, D. A. (2005). Liquidity of emerging markets. *Journal of Financial Economics, 77*(2), 411-452. doi:http://dx.doi.org/10.1016/j.jfineco.2004.01.005

Lesmond, D. A., Ogden, J. P., & Trzcinka, C. A. (1999). A new estimate of transaction costs. *The Review of Financial Studies, 12*(5), 1113-1141. doi:10.2307/2645977

Levine, R. (1991). Stock markets, growth, and tax policy. *The Journal of Finance, 46*(4), 1445-1465. doi:10.2307/2328866

Levine, R., & Zervos, S. (1998). Capital control liberalization and stock market development. *World Development, 26*(7), 1169-1183. doi:http://dx.doi.org/10.1016/S0305-750X(98)00046-1

Levine, R., Philippe, A., & Steven, N. D. (2005). Chapter 12 finance and growth: theory and evidence. *Handbook of Economic Growth* (Volume 1, Part A ed., pp. 865-934): Elsevier.

Lim, A. (2015, January 6). Increasing competition among banks amid new interest rate. *The Borneo Post*. Retrieved from http://www.theborneopost.com/2015/01/06/increasing-competition-among-banks-amid-new-interest-rate/

Longworth, D. (2007). *Liquidity, liquidity, liquidity*. Toronto: Investment Industry Association of Canada. Retrieved from http://www.bankofcanada.ca/2007/10/liquidity-liquidity-liquidity/.

Love, I., & Martinez Peria, M. S. (2013). How bank competition affects firms' access to finance. Available at SSRN: http://dx.doi.org/10.2139/ssrn.2144888

LuxCSD. (2015). Settlement process - Malaysia. Retrieved from http://www.clearstream.com/luxcsd-en/products-and-services/market-coverage/asia-pacific/malaysia/settlement-process---malaysia/6588

Malayan Banking Berhad. (2013). *Maybank annual report 2012*. Retrieved from http://www.maybank.com/en/investor-relations/reporting-events/reports/annual-reports-details.page?detailId=136273679553205

Malaysian Loan. (2011). What if a bank fails. Retrieved from http://www.malaysialoan.com.my/2008/09/what-if-a-bank-fails/

Mankiw, N. G. (2014). *Principles of Macroeconomics* (7th ed.). Connecticut: Cengage Learning.

Maskus, K. E., & Lahouel, M. (2000). Competition Policy and Intellectual Property Rights in Developing Countries. *World Economy, 23*(4), 595-611. doi:10.1111/1467-9701.00292

Mattana, E., & Panetti, E. (2014). Bank liquidity, stock market participation, and economic growth. *Journal of Banking & Finance*(48), 292-306. doi:http://dx.doi.org/10.1016/j.jbankfin.2014.01.016

McLeay, M., Radia, A., & Thomas, R. (2014). Money creation in the modern economy. *Bank of England. Quarterly Bulletin, 54*(1), 14-27.

Mirzaei, A., & Moore, T. (2014). What are the driving forces of bank competition across different income groups of countries? *Journal of International Financial Markets, Institutions and Money, 32*, 38-71. doi:http://dx.doi.org/10.1016/j.intfin.2014.05.003

Murray, J. D., & White, R. W. (1983). Economies of Scale and Economies of Scope in Multiproduct Financial Institutions: A Study of British Columbia Credit Unions. *The Journal of Finance, 38*(3), 887-902. doi:10.1111/j.1540-6261.1983.tb02508.x

NASDAQ. (2013). Bursa Malaysia goes live with its new trading engine powered by NASDAQ OMX. Retrieved from http://ir.nasdaq.com/releasedetail.cfm?releaseid=812831

Niehans, J., & Hewson, J. (1976). The Eurodollar Market and Monetary Theory. *Journal of Money, Credit and Banking, 8*(1), 1-27. doi:10.2307/1991917

Padilla, A. J., & Pagano, M. (1997). Endogenous communication among lenders and entrepreneurial incentives. *The Review of Financial Studies, 10*(1), 205-236.

Pagano, M., & Jappelli, T. (1993). Information sharing in credit markets. *The Journal of Finance, 48*(5), 1693-1718. doi:10.2307/2329064

Panzar, J. C., & Rosse, J. N. (1987). Testing for "monopoly" equilibrium. *The Journal of Industrial Economics, 35*(4), 443.

Pastor, L., & Stambaugh, R. F. (2003). Liquidity risk and expected stock retums. *Journal of Political Economy, 111*(3), 642-685.

Patti, E. B. d., & Dell'Ariccia, G. (2004). Bank competition and firm creation. *Journal of Money, Credit and Banking, 36*(2), 225-251. doi:10.2307/3839018

Petersen, M. A., & Rajan, R. G. (1994). The benefits of lending relationships: Evidence from small business data. *The Journal of Finance, 49*(1), 3.

Petersen, M. A., & Rajan, R. G. (1995). The effect of credit market competition on lending relationships. *The Quarterly Journal of Economics, 110*(2), 407-443. doi:10.2307/2118445

Petersen, M. A., & Rajan, R. G. (2002). Does distance still matter? the information revolution in small business lending. *The Journal of Finance, 57*(6), 2533-2570. doi:10.1111/1540-6261.00505

PIDM. (2016). Coverage For DIS. Retrieved from http://www.pidm.gov.my/For-Public/About-Deposit-Insurance/Coverage

Rajan, R. G. (1992). Insiders and outsiders: the choice between informed and arm's-length debt. *The Journal of Finance, 47*(4), 1367-1400. doi:10.2307/2328944

Rajan, R. G. (1998). *Do we still need commercial banks?* NBER. Retrieved from http://www.nber.org/reporter/fall98/rajan_fall98.html

Randhawa, D. S. (2011). Banking and capital market reforms in Malaysia. *ASEAN Economic Bulletin, 28*(3), 388-413.

Roe, M. J., & Siegel, J. I. (2011). Political instability: Effects on financial development, roots in the severity of economic inequality. *Journal of Comparative Economics, 39*(3), 279-309. doi:http://dx.doi.org/10.1016/j.jce.2011.02.001

Roodman, D. (2009). A Note on the Theme of Too Many Instruments. *Oxford Bulletin of Economics and Statistics, 71*(1), 135-158. doi:10.1111/j.1468-0084.2008.00542.x

Rouetbi, E., & Mamoghli, C. (2014). Measuring liquidity in an emerging market: The Tunis Stock Exchange. *International Journal of Economics and Financial Issues, 4*(4), 920-929.

Sapienza, P. (2002). The effects of banking mergers on loan contracts. *The Journal of Finance, 57*(1), 329-367. doi:10.2307/2697842

Sarr, A., & Lybek, T. (2002). Measuring liquidity in financial markets *IMB Working Paper No. 02/232*: International Monetary Fund.

Scott, J. A., & Dunkelberg, W. C. (2010). Competition for small firm banking business: Bank actions versus market structure. *Journal of Banking & Finance, 34*(11), 2788-2800. doi:http://dx.doi.org/10.1016/j.jbankfin.2010.06.004

Securities Commission Malaysia (SCM). (2001). *Capital Market Masterplan-Executive Summary*. Kuala Lumpur: SCM. Retrieved from http://www.sc.com.my/wp-content/uploads/eng/html/cmp/EXECUTIV.PDF.

Securities Commission Malaysia (SCM). (2011). *Capital Market Masterplan 2*. Kuala Lumpur: SCM. Retrieved from http://www.sc.com.my/92ED7514-1E93-487F-8F4C-317E52BF2F5E/FinalDownload/DownloadId-F5BAF6C739A1F4CC54F062AA5C2B705F/92ED7514-1E93-487F-8F4C-317E52BF2F5E/wp-content/uploads/eng/html/cmp2/cmp2_final.pdf.

Shaffer, S. (1993). A test of competition in Canadian banking. *Journal of Money, Credit, and Banking, 25*(1), 49.

Shaffer, S. (2004). Patterns of competition in banking. *Journal of Economics and Business, 56*(4), 287-313. doi:http://dx.doi.org/10.1016/j.jeconbus.2003.10.003

Shen, Y., Shen, M., Xu, Z., & Bai, Y. (2009). Bank size and small- and medium-sized enterprise (SME) lending: Evidence from China. *World Development, 37*(4), 800-811. doi:http://dx.doi.org/10.1016/j.worlddev.2008.07.014

Siow, L. S. (2016). Private banks lacking scale exit Singapore. *The Business Times*. Retrieved from http://www.businesstimes.com.sg/banking-finance/private-banks-lacking-scale-exit-singapore?link_time=1478584139#utm_campaign=Echobox&utm_medium=Social&utm_source=Facebook&xtor=CS1-3

SME Corporation Malaysia. (2016). Annual report 2015. Retrieved from http://www.smecorp.gov.my/index.php/en/resources/2015-12-21-11-07-06/sme-annual-report

Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. London: Methuen & Co. Ltd. .

Song, F., & Thakor, A. V. (2010). Financial system architecture and the co-evolution of banks and capital markets. *The Economic Journal, 120*(547), 1021-1055. doi:10.1111/j.1468-0297.2009.02345.x

Stein, J. C. (2002). Information production and capital allocation: decentralized versus hierarchical firms. *The Journal of Finance, 57*(5), 1891-1921. doi:10.2307/3094499

Strahan, P. E. (2008). CHAPTER 4 - Bank structure and lending: what we do and do not know. In A. V. Thakor & A. W. A. Boot (Eds.), *Handbook of Financial Intermediation and Banking* (pp. 107-131). San Diego: Elsevier.

Strahan, P. E., & Weston, J. P. (1998). Small business lending and the changing structure of the banking industry. *Journal of Banking & Finance, 22*(6–8), 821-845. doi:http://dx.doi.org/10.1016/S0378-4266(98)00010-7

Tan, C. H. (2000). *Financial Sourcebook for Southeast Asia and Hong Kong*. Singapore: Singapore University Press.

The Association of Banks in Malaysia. (2016). Commercial banks branch tally. Retrieved from http://www.abm.org.my/index.cfm?sc=banking_resources

The Heritage Foundation. (2016). Methodology. Retrieved from http://www.heritage.org/index/book/methodology

Turk-Ariss, R. (2010). On the implications of market power in banking: Evidence from developing countries. *Journal of Banking & Finance, 34*(4), 765.

UOB (Malaysia) Berhad. (2014). *Annual report 2013*. Retrieved from http://www1.uob.com.my/assets/pdf/financial_highlights/Annual_Report31Dec13.pdf

van Leuvensteijn, M., Bikker, J. A., van Rixtel, A. A. R. J. M., & Sørensen, C. K. (2011). A new approach to measuring competition in the loan markets of the euro area. *Applied Economics, 43*(23), 3155-3167. doi:10.1080/00036840903493234

Vives, X. (2001). Competition in the Changing World of Banking. *Oxford Review of Economic Policy, 17*(4), 535-547. doi:10.1093/oxrep/17.4.535

von Thadden, E.-L. (1998). Intermediated versus Direct Investment: Optimal Liquidity Provision and Dynamic Incentive Compatibility. *Journal of Financial Intermediation, 7*(2), 177-197. doi:http://dx.doi.org/10.1006/jfin.1998.0239

Wallace, N. (1988). Another attempt to explain an illiquid banking system: the Diamond and Dybvig model with sequential service taken seriously. *Quarterly Review, 12*(4), 3-16.

Wang, J. (2013). Liquidity commonality among Asian equity markets. *Pacific-Basin Finance Journal, 21*(1), 1209-1231. doi:http://dx.doi.org/10.1016/j.pacfin.2012.06.003

Wearden, G., & Kollewe, J. (2008, October 10). London suffers third biggest fall in 'great crash of 2008. *The Guardian*. Retrieved from https://www.theguardian.com/business/2008/oct/10/marketturmoil-creditcrunch

Wooldridge, J. M. (2013). *Introductory econometrics : a modern approach* (5th ed.). Ohio: South-Western Cengage Learning.

World Bank. (2013). *Malaysia - Financial sector assessment*. Retrieved from Washington DC: http://documents.worldbank.org/curated/en/2013/03/17428461/malaysia-financial-sector-assessment

World Bank. (2015). Worldwide governance indicator. Retrieved from http://info.worldbank.org/governance/wgi/index.aspx#doc

Xu, Y. (2010). *Empirical Essays on the Stock Returns, Risk Management, and Liquidity Creation of Banks.* (PhD. Thesis), Erasmus University Rotterdam, Rotterdam.

Zardkoohi, A., Rangan, N., & Kolari, J. (1986). Homogeneity Restrictions on the Translog Cost Model: A Note. *The Journal of Finance, 41*(5), 1153-1155. doi:10.2307/2328171

Zarutskie, R. (2006). Evidence on the effects of bank competition on firm borrowing and investment. *Journal of Financial Economics, 81*(3), 503-537. doi:http://dx.doi.org/10.1016/j.jfineco.2005.07.008